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ASTRONOMY.

ASTRONOMICAL NOTES FOR MARCH, 1878.

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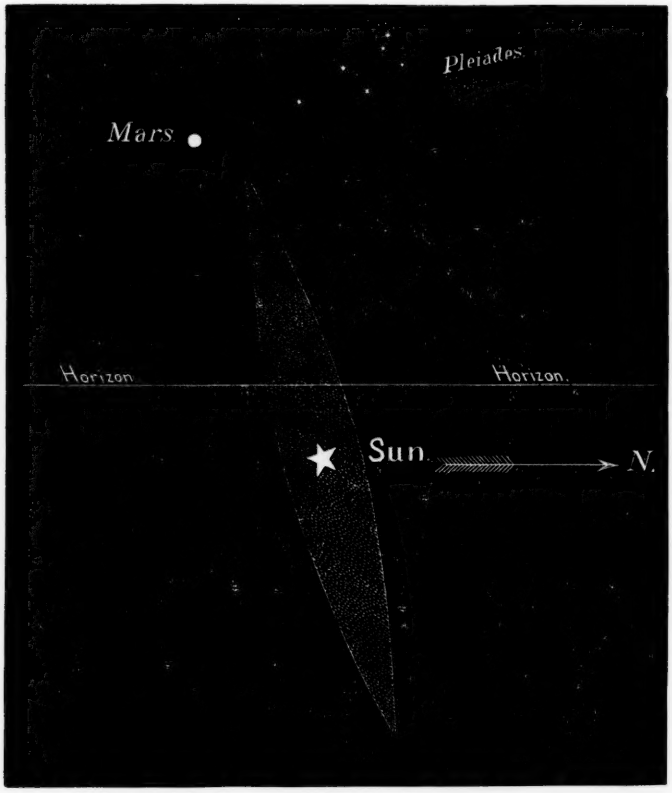
THE ZODIACAL LIGHT.

Some of our recent clear nights have afforded fine opportunities to see this phenomenon at its best. It is, however, really surprising that *so few persons* ever see it during their whole life-time. As I write for students and general readers, rather than for Astronomers, this note is made in the hope of inciting attention to something very *easily seen* and still very *curious.*

The Zodiacal Light, first so called by J. D. Cassini, in 1683, is apparently a faint luminous cone, whose axis extends from the sun, along the plane of the sun's equator, to a distance of from 30° to 105° from the center of the sun. The variable length of the axis is *apparent*, not *real*—and is due to the varying inclination of the sun's equator to our horizon at different seasons of the year. The light is brightest and is recognized as extending farther from the sun the more nearly its axis is perpendicular to our horizon. For hundreds of years to come this season will be March and April for the Western sky, and September and October for the Eastern sky. Any one may illustrate for himself, in two minutes, the *varying* position of this conical axis of light, by revolving a celestial globe, previously adjusted to the latitude of his position. In a minute he can

see that he ecliptic makes the largest angle with the horizon when the *equinoxes* are in the horizon; and since the sun's equator is only inclined $7\frac{1}{3}°$ to the ecliptic, the projected equator of the sun will make its *largest* angle with the horizon nearly at the equinoxes; and, therefore, we *then see* the luminous cone most nearly perpendicular to our horizon. The apparent breadth of the conical base varies from 8° or 10° to 20° or 25°, as we see it more or less obliquely. It is brightest near the horizon, and fades away by insensible gradations towards the



vertex. The light resembles that of the Milky Way, or that of the tail of a faint comet. During last week the vertex was near the planet Mars, and a little west of the Pleiades. The accompanying figure will show its form and relation to the sun, our horizon, Mars and the Pleiades, at $7\frac{1}{2}$ hours mean time, February 28. Its *form* is that of an excessively oblate spheroid, or lens-shaped body. The *figure* will be recognized as a plane section of the spheroid, made through the center of the sun and at a right angle to our axis of vision.

Many speculations have been hazarded concerning its nature. Kepler thought it might be the solar atmosphere, but La Place showed this hypothesis to be untenable for these two reasons: 1. The solar atmosphere cannot extend beyond the distance at which the centrifugal force, due to rotation, would be balanced by the sun's attraction. This point lies within the orbit of Mercury, or within less than 28° from the sun. 2. The ratio of the axes of the spheroid of atmosphere must be within these limits, Major : Minor : : 3 : 2, while the *actual ratio* is incomparably greater. Cassini thought it might be the blended light of an innumerable number of very minute bodies revolving round the sun. Euler thought it proceeded from the repulsive energy of the sun, after the manner of comets' tails. Sir John Herschel says: "It may be conjectured to be no other than the *denser parts* of that medium which we have some reason to believe resists the motion of comets, loaded, perhaps, with the actual materials of the tails of millions of these bodies, of which they have been stripped in their successive perihelion passages." In conclusion, it is but right to state that *trustworthy* observers have testified to the *simultaneous* presence of the luminous cone in both Western and Eastern sky. See Gould's Ast. Journal, No. 84, for May, 1855; also Monthly Notices R. A. S., vol. xvii., and Fourth Ed. U. S. Exploring Narrative, Washington, 1856. Of the same tenor is a communication of Humboldt to the Berlin Academy, July, 1855. Mr. Jones, Chaplain of the U. S. steam frigate Mississippi, during a cruise round the world, had *very rare* opportunities for observing the zodiacal light in all latitudes, and seems to have improved them very diligently. He remarks: "It seems to me that these data can be explained only by the supposition of a nebulous ring, with *the earth for its center*, and lying within the orbit of the moon."

SIRIUS.

This distinguished star is now near the Meridian during evening twilight, and 56° south of our zenith. The *brightest* of all the fixed stars, it *just now* compels the attention even of the most *casual observer*. From remote ages it has been called the Dog Star. (Canicula.) Its proper Astronomical name is Alpha Canis Majoris. The ancient Egyptians gave it the name Sirius, from Siris, one of the appellations of the Nile, because they noted the annual inundations of that river to occur at a certain rising of this star. Not only in antiquity, but in times comparatively modern, the most malign influences have been ascribed to this resplendent sun. See Georg. Virg. IV, 425, Æneid III, 141, Æneid X, 273, and numerous passages in modern writers. This malign influence was supposed to culminate in the season known as dog days—"diebus canicularibus." This indefinite period of about 40 days begins when Sirius rises and sets heliacally—that is, *with* or *nearly with* the sun. Such a concurrence now requires the sun to be situated in Cancer, near Præsepe. In antiquity this rising of Sirius came early in July, and Dog Days embraced the hottest part of the summer. Owing to the Precession of the Equinoxes, they now fall in a cooler season of the year, beginning early in August, so that hot days, raving madmen, rabid dogs, parched fields

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and malignant fevers no longer come because "the Dog Star rages." The light of Sirius is now intensely white; but it was anciently described as red or yellow, and Seneca says it was ruddier than Mars. Its Parallax is about 0.2", and therefore it is about one million times more distant from us than our own Sun; and yet its brightness is so dazzling that the eye can scarcely bear it. Its approach to the field of a large telescope is heralded by a halo of light which grows brighter and brighter, until the mighty orb, equal perhaps to eighty of our suns, appears in overpowering splendor. Dr. Huggins, President of the Royal Astronomical Society, London, and our countryman, Mr. Rutherford, find by the Spectroscope that Sirius, like our own Sun, is enveloped by an immense atmosphere of Hydrogen under great pressure; and the peculiar position of one of the hydrogen lines indicates a motion of *direct recession* from our system at the rate of more than 20 miles per second. It has also a proper motion, nearly at right angles to our line of vision, of about 15 miles. The resultant of these motions gives a motion in space of about 30 miles per second. Some of the most recondite labors of astronomers have related to the proper motion of Sirius. The peerless Bessel gave it his most searching investigation. Still there was a concealed element of perturbation until the year 1865, when Mr. A. G. Clark first saw with the Chicago refractor its companion star. The first decisive measures (so far as I know,) of the *position angle* and *angular distance* of the companion of Sirius, were made with the great 26-inch refractor of the Naval Observatory, Washington. Lately Herr Tempel, of Florence, in charge of the observatory at Arcetri, (the old home of Gallileo,) met with a remarkable *experience* in investigating the companions of Sirius. His instrument, the Amici refractor, seemed to reveal *another* companion between Sirius and the Clark star. But unfortunately, when he turned the telescope on Venus and some other bright stars, he still saw the same minute companions, which apparently are only "ghosts," having their origin in light doubly reflected. Herr Tempel seems to conclude that even the Clark companion is but a "ghost" of false light. It may serve to show the difficulties of these observations to add that the learned and veteran astronomer Otto Struve, at Pulkova, for several years mistook a "ghost" for a companion of Procyon. The Washington refractor was also the first to remove this illusion. For the same reason we sometimes hear of new companions to Polaris. Last year a Frenchman reported two. In view of all lately said in highest astronomical circles on the companion of Sirius, I can but feel some gratification relative to measures I have lately made of the Clark companion. I can confidently risk the following values of the position angle and distance of this attendant of Sirius:

Date.	Position Angle.	(Wt.)	Distance.	(Wt.)	No. Comp'ns.
1878. Feb. 26.	57°.25	(4)			4
" 27.	58°.23	(3)			5
" 28.			11".140	(5)	6
Mar. 5.	55°.55	(4)	11".341	(4)	6—2
" 6.	54°.83	(4)	11".344	(4)	7—6
Mean.....	56°.41		11".265		

The following measures were published by Prof. Hall, in Ast. Nach. 2097, all made on the Great Refractor, at Washington:

Date.	Observer.	Pos. Angle.	Dist.	No. Comparisons.
1876.033	Watson, Ann Arbor, Mich.	57°.8	11″.12	1—1
1876.055	Peters, Clinton, N. Y.	54°.6	11″.45	1—1
1876.095	Holden, Washington.	54°.87	11″.822	6—5
1876.219	Hall, Washington,	55°.22	11″.193	6—6

The values given in the Washington observations for 1874 are for the Pos. Ang. generally *larger* than those above. The mean of Prof. Newcomb's values for that year, giving the observations equal weight, are:

Pos. Ang., 59°.33; Dist., 11″.53.

PLANETS.

Saturn. The disappearance of Saturn's Ring, (Feb. 6.) was watched, with much interest, by Astronomers all over the world. Fortunately, the weather here enabled us to share that interest. On Feb. 3rd, 7½ p. m., (the planet being low in the S. W.) the Ring was very carefully scrutinized for half an hour. It appeared projected on the *Ball*, as a very sharp, fine, *dark line*. On each side of the Ball it was still *distinctly* seen as an *excessively* fine, *continuous, white line*. Three Satellites distinctly visible on the following side.

Feb. 4, at 6½ p. m. For twenty minutes a wide opening in the clouds afforded a fine view of Saturn and his vanishing Ring. Across the Ball the Ring was still distinctly seen, sharply projected in a fine, dark line. The ends towards the ansæ, still very fine, white lines—in some parts a series of bright, *broken lines*. Two Satellites visible.

Feb. 5th, at 6½ hour. The projection on the Ball could be seen but not *constantly*. On the *preceding* side the Ring could only be seen near the Ball—on the *following* side was a diffusion of light near the ansæ, which may have been caused by a Satellite; for the *seeing* was very much interrupted by atmospheric disturbance. Three Satellites seen.

Feb. 6th, 6½ hours. Observed the Ring when planet was *too low;* also a haze impaired vision. No traces of the Ring on either side of Ball, except perhaps near the ansæ, and this appearance was very uncertain. On the Ball, with the *highest effort* of vision, I think I could detect faint traces of the Ring. One thing was *certain*—this wondrous appendage of Saturn had vanished. The shorn appearance of the great planet quite disgusted my youthful assistant, who declared "he looked worse than a peacock with his tail pulled out." The Ring having remained invisible nearly a month is now beginning to show again; but Saturn is too near the Sun for any valuable observation.

Mars is a little S. W. of the Pleiades, and is filling the important post of "Evening Star" as well as his shorn glories will allow.

Neptune is invisible to the unassisted eye, yet, with Mars, is doing duty as "Evening Star." With a good spy-glass any one may see him now at a point a

little S. of the half-way point between Alpha Arietis and Alpha Ceti. The trouble will be to *know* him when seen.

Uranus is now in a position that, on a clear night, (the Moon being absent,) any one may identify him with the unassisted eye. Find Regulus (Alpha Leonis) and then look about 1½° W. and nearly 1° N., and you see Uranus. The eye will have to be practiced a little to recognize him. It is now retrograding, or moving west. Nothing can show more decisively the superiority of modern achromatic telescopes, over the earlier instruments of Sir William Herschel, than the fact that Sir William remained so long in doubt as to the character of the "Georgium Sidus." For a long time he considered it a comet. A very moderate refractor of the present day soon reveals its true character. The satellites of Uranus are plainly seen in our Equatorial, but no effort has yet been made to measure them. Extended measures of 4 of them, also of the satellite of Neptune, made with the Great Refractor, at the Naval Observatory, were published by Prof. Hall in Ast. Nach. 2097. Jupiter and Venus are now both morning stars, and are very conspicuous in the eastern sky in morning twilight. Jupiter is still very far south—more than 20° S. of the Equator. He has, however, been returning northward since Nov. 1. Still, several years must elapse before he will be favorably situated relatively to the observers of northern Europe. His variegated belts and his satellites, with their *transits*, *shadows*, *occultations* and *eclipses*, are objects of *unceasing* interest to the astronomers. Thus on Aug. 15th, 1876, while Sat. No. I was under occultation, I saw at the same time the *shadows* of Satellites II and III, projected on the disc, while No. II itself was just passing off the preceding limb.

Mr. Barneby, of Morton House Observatory, England, reports that on July 21st, 1867, he saw *three satellites* and *three shadows* projected on the disc at the same time—a rare sight indeed.

Mercury is also a morning star; but is too near the sun to be seen. He will reach superior conjunction March 20, and at his ensuing *inferior conjunction*, May 6, (civil time,) transits the disc of the sun. Extensive preparations are being made by astronomers to observe this transit of Mercury, chiefly to afford the "data which will be decisive of the question, whether the result of Le Verrier, that the motion of the perihelion of Mercury is much greater than that due to the action of known planets *is really correct.*" In other words: The observations are wanted to indicate the *probabilities* of an Intra-Mercurial planet—already named, in advance, Vulcan. Instructions drawn up by Professor Newcomb, of the American Nautical Almanac, have been issued by Admiral Rodgers, from the Naval Observatory, inviting coöperation and uniformity of observations. We hope to be able to take part in these observations.

ASTEROIDS.

This observatory was promptly notified by telegraph during the last month, through the Smithsonian Institution, of the discovery of three new minor planets,

of magnitudes 10, 11, 12, respectively; all found by Palisa, at Berlin. Unfavorable weather has not allowed us to follow them.

METEOROLOGY FOR FEBRUARY, 1878.

Height, 700 feet above sea level.

Highest Barometer,	Feb. 26,	29.612 in.	Reduced to sea level,		30.343 in.
Lowest "	Feb. 21,	28.590 in.	"	" " "	29.106 in.
Mean "		29.162 in.	"	" " "	29.906 in.
Highest External Thermometer,		54.50F.,	Feb. 5.		
Lowest "	"	26.00F.,	Feb. 10.		
Mean "	"	40.59F.			

Rainfall for the month, 3.133 inches.

On Feb. 21 the barometer was lower than at any date since Oct. 20, 1876. *That date* was marked by a violent S. W. wind lasting 7 hours, the sun shining brightly and broken clouds flying. No rain. This *latter fall* by gentle N. E. winds and very heavy rains.

ASTRONOMY AND THE CALENDAR.

Professor D. G. Eaton, of the Packer Institute, Brooklyn, New York, lately delivered a lecture in that city on the above subject:

There are three great natural units necessary to the measurement of time. These units are found in the movements of the celestial bodies. The first is the revolution of the earth upon its axis, which measures day and night. This is the foundation of all measurement of time. The rising and setting of the sun is not uniform, but the time of the rising and setting of a star, such as Sirius, which may be seen near the meridian, is the same throughout all agse. It was the same a thousand years ago, and will be the same a thousand years hence. The other natural units of time are the month and year. Such an adjustment of the civil to the natural year as shall cause the perpetual recurrence of the seasons upon the same month is what constitutes the calendar. The artificial units of time are the week, hour, minute and second. The account of the origin of the week can be found nowhere except in the books of Moses, though it is a division of time that was known to all the civilized nations of antiquity. It was not, however, until after the time of the Emperor Theodosius that it was introduced among the Romans. The lecturer at this point gave an explanation of the way in which the days of the week were named by the ancient Egyptians and renamed by the Saxons. He also gave an account of the confusion which was caused in the Roman calendar by the vanity of the Emperor Augustus, who, after having the eighth month of the year named after himself, caused another day to be added to the number which it contained before, that the month of July (named after Julius Cæsar) should not exceed it in length. To regain the balance of days in each month, one day was taken from both September and November. English jealousy of the Papal power also caused confusion in the uniformity of the calendar

by hesitating for more than two hundred years to accept the change in the old style of reckoning recommended by Pope Gregory and accepted at once by all Catholic countries. It was in 1752 that the new style was adopted in England by act of Parliament, and it has not yet been introduced into the Russian Empire. The motive which induced Pope Gregory to make this important change, which for a long time created so much confusion, was merely to regulate the recurrence of Easter Sunday. Though the motive was apparently of such slight importance, yet the result has been of great good to mankind. It is still a matter of difficulty for chronologists to settle the date of events which occurred in the remote past, and their task has not been lightened by the changes made in the calendar by some of the Roman emperors and the pontiffs of the Catholic Church. Professor Eaton's lecture was illustrated by off-hand sketches on the blackboard.—*Scientific American.*

TRANSIT OF MERCURY.

The arrival in this city of two French scientists, on their way to the West to make observations on the transit of Mercury, indicates the interest with which that astronomical event will be regarded. These gentlemen are sent out officially. M. Charles Andre is Director of the Observatory and Professor of Astronomy in the University of Lyons; M. Angot is Professor of Physics at the Lycee Fontanes, in Paris. They are to proceed to Ogden, Utah, there to make observations on May 6. Ogden has probably been selected for two reasons. It is upon very elevated ground, being nearly on the "divide" of the continent, and offers great advantages in dryness of climate and purity of atmosphere. It is also a point where the center of transit will be nearly at local noon. The transit will occupy about seven and a half hours. Observations will be of service in determining the orbit of Mercury, and thus throwing more light upon the question of an intra-Mercurial planet; and also in furnishing the data for fresh estimates of the distance of the sun.

GEOGRAPHY.

POLAR EXPLORATION IN 1776.

TRANSLATED BY PROF. E. L. BERTHOUD, COLORADO SCHOOL OF MINES.

Extract from the journal of Capt. Pagei, of the French Navy, who, in a Dutch ship in April and May, 1776, made a voyage to the north of Spitzbergen, to Jan Mayen Island, to the land of Gail Hawkes, in the N. E. part of Greenland, with his views on the possibility of reaching the North Pole. Capt. Pagei reached in May to a point above 81° N. lat.

"Remembering all I have seen of the motion of the ice pack, and the wish I had to penetrate to the North Pole; when on this trip we had reached beyond 81° North latitude, I reflected seriously upon the practicability of this idea:

"The force of the several motions of the ice pack had convinced me that in the coldest winters the sea congealed by a hard frost must soon be broken up by the motion of the larger ice floes.

"The conformation of floes formed of several pieces made this certain to me.

"The parts that froze and joined together the ice sheets that I saw must be the water space between the floes, which became compressed and thus drifted around.

"I believe that this motion of compression (in English, nipping) takes place in all the ice covered seas, and even at the poles if there were seas there, and where we would always find currents. If this theory of mine is just, the ice pack has space to move in, and all the surface of the polar seas is not, therefore, wholly covered with ice; and therefore navigation is possible there.

"I saw in this voyage, at 81° north latitude, the sea suddenly and rapidly freed from ice, that *had drifted north*, where evidently it had drifted into open water.

"I knew also that some Dutch ships in 1773 had, as late as the end of November, safely sailed out of the great northern ice pack. The expeditions of the Dutchmen, Heemskerk and Banentz, to the northeast of Nova Zembla, and those Russian explorers of the sea spaces between the rivers Lena, Obi and Yenisei, told me that they were sometimes beset and again free from all ice fields. The movements of the ice pack were thus prolonged until the end of November also in the Siberian seas. I think, however, that these two seas are the least favorable for a polar expedition.

"The seas of Siberia having no issue south, a restricted one east or west must keep continually the greater portion of its heavy ice; while the sea of Spitzbergen, receiving the currents from the east, has the drift ice added to its own ice fields. I think, therefore, that the space comprised between Spitzbergen and Nova Zembla is the most practicable, on account of its width and extent. The experiences of former travelers, and the motions I had seen of the ice pack, showed me we must keep away from land.

"I however do not believe that N. NW. of Nova Zembla we would find any sea entirely free from ice, but a sea only partially encumbered by it, which would give us a navigation as easy as that we have had to a point sixty miles to the north-west of the island of Spitzbergen.

"A ship destined for the North Pole should start from the streams of the German Ocean in the end of February, so as to reach the edge of the ice pack by the end of March, there to wait for the first favorable opening. Whale ships frequently reach the parallel of 80° north latitude the 15th or 20th of April. Those who go to Davis' Straits generally leave about the 1st of March, and we know these regions are far more tempestuous than the more northern seas. The month of March and the beginning of April would in no manner be too early; for April, May and June are the cleanest months for navigation, as July and August are foggy and rainy.

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"As, however, we penetrate farther north, from the lessened force of the sun's rays, we necessarily must have there less fog and mist than in the more southern latitudes, and much less solar evaporation."

We give to our readers this short summary of what an experienced traveler and a good sailor, one hundred years ago or more, gave as his idea of the feasibility of reaching the North Pole. The interest taken in Capt. Howgate's plans, and the late discovery of Franz Joseph Land, north of Nova Zembla, by Peyer I. Meypreslet, the Austrian explorer, have in this old voyager's experience been fulfilled. The Austrian expedition took the very same course recommended by Capt. Pagei, and discovered the circum-polar continent or archipelago.

Capt. Pagei also made part of an expedition (French) of discovery sent out first to find the continent alleged to have been discovered east of the Cape of Good Hope, by Capt. P. Gonneville, 1503-4. They discovered some islands on the shore of the South Antarctic Continent, before unknown, and saw these lands previous to Capt. Cook's voyage to the South Antarctic Ocean. E. L. B.

GEOGRAPHICAL PROGRESS.

The annual address of the President of the American Geographical Society furnishes, as usual, an interesting review of the past year's work in geographical exploration. The grandeur of Stanley's achievement dwarfs all the rest to relative insignificance; nevertheless enough else was done in other parts of the world to make the year a notable one for geography, even with Stanley's work left out.

In our own Western Territories, and in certain portions of South America, an unusual number of expeditions for geographical exploration have been sent out; and considerable good work has been done, also, in Central and Eastern Asia, the Indian Archipelago, and Australia. In Asia many explorers have been at work in Palestine, Persia, Turkistan, Thibet, China, India, and Japan. In South America, Rivira and Werthemere have explored the mountains of Peru; Weiner has been at work in Bolivia, and Moreno in Patagonia.

At home the explorations of the United States corps of engineers have been, as our readers already know, both extensive and notably successful. The same may be said of the surveys under the direction of Professor Hayden. Of more immediate interest to ourselves has been the resurvey of the Eastern portion of our own State. The triangulation has been carried through the eastern central part of the State, covering an area of 3,000 square miles between the Hudson river and the sources of the Mohawk, as far west as Utica, and embracing parts of eleven counties. During the coming season the triangulation will be carried across the entire State. The work is of the highest order of accuracy, every important point being located with absolute precision. Thus far the survey has not found a single town where it was represented to be on the old maps, many of them being a mile out of the way.

In Central America the reconnoissance of Lieutenant Wyse, of the French navy, has exploded the reports which the French have held to, (in spite of the

abundant testimony of American explorers to the contrary), that a ship canal without locks was possible across the Isthmus of Darien. His conclusion is that no navigable channel is possible between Tuyra and Otrato, without locks or tunneling. The researches of Dr. Le Plongeon among the ruins of Chichen Itza, Uxmal, and Aké, in Yucatan, and on the once-famous islands of Azumel and Mujeres, are mentioned with commendation; and the doctor's claims to the discovery of written and other evidence of communication between the people of Yucatan and the ancient people of the west coast of Africa are favorably noticed.

No real work was done in Arctic regions; considerable attention, however, is given to Barry's reports with regard to the finding of relics of Sir John Franklin's ill-fated expedition, near the Gulf of Boothia, north of Hudson's Bay. Sir Leopold McClintock has intimated to the British Admiralty that Barry's story is not worth much; Justice Daly, on the other hand, is convinced that Barry not not only means to tell the truth, but has a sufficient acquaintance with Esquimaux speech to make his report of Esquimaux stories trustworthy. He believes, further, that the information Barry gives is sufficient to justify the sending of an expedition to examine the spot where the Netchelli say the white men died, and where their cairn is, containing books and papers.

Stanley's conquest of the Congo is next reviewed at great length, and his course in fighting his way, when opposed, is unreservedly justified. Summing up the whole of Stanley's work in Africa, the speaker said, "It may truthfully be said that no man has ever, in explorations upon the land, done so much for the acquisition of geographical information," and with respect to the Congo and the Nile, "He has solved an enigma that has attracted the attention of the world for ages, and has fixed his name in the foremost rank of geographers, explorers, and travelers."—*Scientific American.*

FOREIGN CORRESPONDENCE.

SCIENCE LETTER.

PARIS, February 19, 1878.

That high authority, Claude Bernard, states consumptive diseases are curable, as well as all others which use or consume the organism, such as scrofula, gout, diabetes, inveterate drinking, etc. Respecting the latter malady, drunkards can be cured, but on condition that the stimulants be gradually withdrawn. To suppress alcoholic drinks suddenly would result in the certain death of the patient. In the case of consumption, irrespective of its origin, not much medicine is required to kill the disease. The remedy lies in a rational hygiene, practiced

with exactitude and severity. Patience is above all necessary on the part of the sufferer, who must not agree with La Rochefoucauld, that the excessive curing of one's health is in itself a malady. The majority of consumptive people who die are those who either could not or would not cure themselves. Individuals afflicted with phthisis, and whose social position condemns them to work and live in vitiated atmospheres, are doomed to certain death if they cannot remove to the country. People in comfortable circumstances can be cured if they adopt, at the commencement of the malady, ordinary precautions. These observations constitute the *credo* of doctors whose specialty is to treat consumption.

M. Bouchardet calls pulmonic, and kindred affections, maladies of "physiological misery," which is very true, as they spring from a general alteration of the organic functions, owing to a default of tone: the organism lives no more, because it nourishes itself no more. Take a consumptive patient out of the contaminated medium in which he lives; place him during the summer among the Alps and the Pyrenees, and in winter on the shores of the Mediterranean; if he live the life of a patient, and not that of a man of the world, avoiding fatigue, cold and humidity, this mode of existence will bring about a complete cure. It must not be concluded that climate has in itself anything like a panacea; a temperate climate offers the afflicted only opportunities for safe and salutary exercise and the conditions for a better appetite. But the more one advances in years the less sensibly these changes are felt. However, in the eyes of doctors, we are old or young at all ages, that is, we represent the age of our organs.

It is, above all, in diabetes that the necessity of minutely following medical injunctions becomes apparent. It is a disease where the sufferer may be said to gradually dwindle away; let him grow fat or let him get lean, he loses his moral and physical forces, and becomes every day a more certain prey to exhaustion. The afflicted may eat and drink voraciously, but gains nothing in energy; the system expends more than it receives; the constitution resembles the sieve of the Danaides, and the patient actually dies from starvation—while eating and drinking, even to excess—if not carried off by pulmonic inflammation. In general, diabetic persons are rich, and so can cure themselves; but it is a mistake to conclude that this disease, as well as gout, is the peculiarity of millionaires; these maladies avoid persons whose occupations are of the manual and out-door kind, and go to seek the denizens of comfortable firesides and delicately served tables—the banker, the notary and the politician. Next to notaries, priests are most subject to diabetes, not as the consequence of dining at rich parishioners' tables, but having to make long fasts, they have to indulge afterwards in copious meals, which fatigue the stomach; then their attendance in chapel affords but little time for exercise, and the building itself presents the extremes of heat and cold, for nothing produces diabetes more quickly than a cold, humid atmosphere, and the contrary is the most efficacious remedy, as well as all manual sports, garden laboring, but especially gymnastic exercises. These restore the functions of the skin and the action of the digestive organs.

The dietary for the diabetic reveals some curious scientific facts: it ought not

to be farinaceous, as the fecula becomes changed into sugar, owing to the saliva producing fermentation. It was thought that if peas and kidney beans could be introduced unbroken into the stomach, and thus escape mixture with the saliva, that a sufferer could enjoy a change of food, but Claude Bernard has demonstrated that sugar is produced in the intestines by the fermentation promoted by the secretions of the sweet-bread. Mountaineering is excellent for the diabetic, because it exercises the lungs, compelling all their cells to work, for it is a law that organs which do not work degenerate; hence, why idle lung-cells soon contain deposits of hard, diseased matter, which becomes purulent—this is tubercular consumption. Almond biscuits are better than gluten bread in diabetes, and effervescing beverages should be avoided: the appetite ought never to be fully satisfied, and sobriety as much observed as exercise. The remedy is not in the chemist's shop but in the kitchen, and our legs are the most powerful allies of the stomach in the process of digestion.

The scientific world is indulging in a kind of *fete* in honor of the discovery of "the liquefaction of the gases," and which is a striking proof of the exactitude of modern theories. For the chemist, as for the philosopher, matter is only one, for whom variety in bodies depends solely on the grouping of the constituent atoms; being more or less dense or gaseous as these atoms are kept asunder by the heat they contain. Thus a gas is but a liquid deprived of its heat, and a solid only a liquid from the same cause. Again, theoretically the difference between gas and steam is slight: gas is steam largely distant from the boiling point. It remained, however, to demonstrate that gas was but vapor, and even only a liquid. Monge transformed into a liquid that suffocating gas generated when a sulphur match is burned, in the form of sulphurous acid; Davy and Farraday liquefied chlorine, and Pouillet carbonic acid, ammonia, etc. Thilorier produced solid carbonic acid, and that oxide of nitrogen, or laughing gas, which dentists employ in "painless tooth extraction." Solid carbonic acid resembles snow; if a portion of it representing a temperature of 200 degrees below zero be placed on the hand, no severe cold will be experienced, because the gas in slowly volatilizing separates it from the skin; but touch the acid on the upper side, and the skin will be seared as if with a red-hot iron.

Till a few weeks ago there were five gases that resisted the highest pressure, the best known of these were oxygen and hydrogen, which form water when combined, and nitrogen and oxygen that constitute common air. Messrs. Cailletet, in Paris, and Pictet, at Geneva, have liquefied these gases. The former has devoted ten, and the latter five, years to the experiment, which demonstrates that all bodies can take a solid, liquid, and gaseous form. When a gas is compressed, its atoms are brought more closely together, and the heat which kept them asunder, is set free. Less than the thousandth part of a cubic yard of gas contains one milliard of milliards of atoms. When a compressed gas is liberated it seizes, in order to expand, on the heat in its vicinity, and this seizing of heat produces cold, to as much as 636 degrees below zero, according to Poisson. M.

Cailletet has utilized this freezing power, which is the secret of his success. He places a strong glass tube in a kind of solid bomb shell; the closed end of the tube projects; the tube being filled with the gas, a force pump drives a column of mercury into the tube, piston-like, which in turn forces the gas to the end of the tube, reducing its volume 300 times less; the pressure being suddenly withdrawn, the gas in expanding seizes any heat in the vicinity of its atoms, producing such a low temperature that a portion of the gas becomes for a few moments cloudy, then some beads of liquid are formed, or several flakes of snow-like matter. Such is the discovery in all its simplicity. M. Pictet has obtained one and one-half ounce of liquid oxygen, which has the density of water, and in which carbon burned with extraordinary brilliancy. There were flakes of solid oxygen in the liquid. M. Cailletet obtained drops of liquefied common air. No industrial or commercial advantage is to be expected from these beautiful, these wonderful discoveries; air from the country cannot be manufactured into wafers, nor that from the Alps imported in blocks, or struck into medals. It is the chemist, not the poet, that "gives to airy nothing a local habitation and a name." Liquefied oxygen can neither be employed as an elixir, nor as a blow-pipe in factories. It could not be contained in an ordinary bottle, for, in expanding, it would knock down a man, and the liquid would burn him like a corrosive. Besides, Paul Bert has shown that compressed oxygen is poisonous, and in a liquid state would kill more infallibly than prussic acid. In an industrial point of view, compressed oxygen would be too costly; further, the ordinary machines for supplying furnaces with condensed air are as ample as they are cheap.

M. Rambossen, in his work on the *Harmony of Sounds*, professes to cure nervousness by means of music; following the nature of the crisis, he would prescribe the music of Meyerbeer, Herold, etc. The idea possesses originality at least. Animals become cruel, mild or timid, under the influence of music. Pending the First Revolution, a concert was given to the elephants in the Zoological Gardens of Paris; the orchestra, composed of noted musicians, was concealed; on hearing the sounds, the elephants pricked up their ears, quit eating some tempting food, approached with lifted trunks and marched to the measure to the spot from whence the sounds proceeded. Arago relates that Ampére could not bear learned, complicated music, but that he cried like a child, when listening to a simple air. As a proof of the influence of music on the nervous system, it is only necessary to observe the howling of a dog — thus testifying his disgust — to the grinding of a barrel organ; the animal, however, will not protest if a lively song be executed in its presence, and it listens to the melodious tones of a harp. There is music for dogs, as for men, and this thesis the author has ably sustained before the Academy of Science.

When the hand is placed on a leaf attached to a plant, and exposed to the sun, the sensation of cold is experienced; if the leaf be plucked, and then placed on the hand, heat is felt. M. Boussingault explains this physical function

to the cessation of the ascent of the sap in the leaf, and the consequent suppression of that evaporation which is the cause of the cold. M. Fautrat continues his interesting studies on the influence of forests on soils and climate. The frigorific action of a forest is most marked in summer, in woods of "leafy" trees the temperature is lessened by one degree, and in the case of pines by half a degree more. The finer the constituents of a soil, the more slowly are the sun's rays absorbed. For resinous trees, other than pines, the temperature is higher during the day — the solar heat retaining the vapors above the tops of the trees; hence, this *milieu* humid and warm, in developing a vigorous resinous vegetation on poor soils. By reason of the differences in temperature above, beneath and around forests, there is a constant circulation of currents, carrying the vapors of the soil above the summits of the trees, connecting thus with the clouds, and acting as lightning conductors, for it is well known that forests keep away hail storms.

Many hold that the flesh of mammiferous animals is the prototype of a complete alimentation. However, it is not the less true that the peasantry in France do not possess an appearance less robust or healthy, because partaking of meat only two or three times in the year. Instead, they have milk or lard with their wheaten or rye bread or potatoes. Drs. Bertillon and Gübler maintain that persons who live on a vegetable diet have their arteries prematurely hardened, owing to carbonate and phosphate incrustations — not unlike the deposit on the inside of a kettle. Instead of being yielding and supple upon being touched, the artery feels hard like the barrel of a quill, resembling the condition in advanced age; ruptures of the arteries ensue. Rich people partake largely of meat and albuminous food containing but little mineral matters, and so their arteries remain elastic; a vegetable diet represents much calcareous salt, that is deposited, or lines, the insides of the arteries. This chalky degeneracy is said to be very common among rice-eating people.

M. Guellemin has brought out a fifth edition of his *Ciel;* it may be said to be re-written; the explanation is clear, the style simple, and the method natural. There are ten years of new observations in the work, and the numerous plates of the phenomena of the heavens make us feel that we are surveying space with a telescope. But nothing is left to caprice or imagination; the author, by a pencil as lucid as his pen, has constituted himself a kind of eloquent secretary of all the observatories of the world. Even astronomers will peruse the book with pleasure.

F. C.

THE GERM THEORY.

From the Popular Science Monthly.

In your February number, Dr. J. R. Black assumes to correct Dr. Niemeyer's statement that the night air of large cities is less noxious than the stirred-up air of the day time, and he does so with a degree of confidence that seems to imply that there can be no such thing as doubting that he speaks *ex cathedra.*

Now, Dr. Black evidently believes the insalubrity of city air depends upon the amount of non-respirable gases that may be diffused into the respirable ones; and is wholly independent of the condensible effluvia of the vaporous kind, or of the organic germ-dust that the heat and stir of the day may keep suspended, but would settle with the cooling and quiet of the night.

Now, while the precise application of the law to cities has not been made before, perhaps, in your journal, the teaching which inevitably leads to it has been abundant, and from unquestionable authority, so that, if Dr. Black wishes to correct so fatal an error as he charges this to be, he is very late with his solicitude. One lecture of Tyndall's, published by you, devoted much detail to the experiments of the professor, in his attempts to bottle a sterilized infusion in the laboratory of the Royal Institution, in air he had attempted to sterilize there, and explaining that he did succeed in a special chamber elsewhere. If, as Dr. Black would imply, noxious effluvia obey the law of diffusion of permanent gases, how comes it that they specially hover over low marshes and putrefying cesspools, while the ascent of a mountain of considerable elevation carries us above malaria and aërial infection, and often above bacterial decay?

A recent experiment of Tyndall's was to sterilize a bottle of infusion and open it upon the brink of a precipice, and, after contact with the air, recork it, to observe whether the infusion retained its sterility or not. He found the air germless. The experiment was made to test this identical question of the settling of ferment-germs.

Pasteur tried similar experiments, ascending to high points in Paris, bottling and comparing the air so bottled in putrefactive power with the air bottled upon Mont Blanc, and with the air of the streets of Paris, always with the result of finding the air of the street levels more laden with micronymes than that obtained at considerable elevations. Upon the western plains, before civilization had scattered its filth, laden with zymogens, meats hung up in the air, even in midsummer, would keep sweet for days. The Emigrants in 1849, in crossing the plains, were surprised to find often the carcasses of dead animals of a previous caravan, drying up, viscera and all, without decay. This is easily explained on the germ theory; without, it is inexplicable. If Dr. Black has any evidence that the germ theory of decay and zymotic diseases is untenable, he should presently submit it, for, to my thinking, the world is only waiting to hear from Dr. Charlton Bastian, when the testimony and argument will be declared closed.

Respectfully, C. W. JOHNSON.

ATCHISON, KANSAS, February 20, 1878.

EDUCATION.

CO-EDUCATION.

BY PROF. G. C. SWALLOW, UNIVERSITY OF MISSOURI.

The discussion of the co-education of the sexes has brought out some very remarkable facts respecting the girls in the wealthiest and most enlightened portions of our country—those parts including Boston and New York as centers. We are told, to prove the physical incapacity of girls for the higher co-education, that in the New York Normal College for girls, during two years, more than one-half of the pupils were daily absent, mostly from sickness; and "that it was no uncommon sight to see three or four young ladies carried out of the chapel in a fainting condition." If this is a fair representation of the physical condition of the New York girls—and if it is not, those publishing it have perpetrated a pitiful fraud—the civilization of that portion of the country is a miserable and criminal failure. If the women have so degenerated as to be incapable of five hours of school duties per day without incurring such fearful results, they surely must be wholly incapacitated for the duties, pleasures and honors of domestic life. If the mothers of a people have so little stamina as these facts indicate, the men as well as the women of the next generation must be wholly incapacitated for the first and highest duties of the race. These puny people must die out, and some stronger stock take their places. This result is as inevitable as the laws of nature. The Creator does not rely upon such debilitated women for the fulfillment of the gl rious destinies of the human family.

But the fact that these abnormal girls of the New York Normal College cannot endure the hardships of school life does not prove that our normal girls cannot successfully compete with our young men for the collegiate honors of our highest schools. But it does prove that the New York Normal College—though not co-educating—is not a fit school for the girls who try to pursue their studies in it. Any school which cannot secure a daily attendance of one-half its pupils, and from whose chapel "three or four girls are commonly carried out in a fainting condition," must have some radical defect. Either the pupils need a hospital more than a school, or the school-room must be a pestiferous source of debility.

But we leave the New York authorities to settle the question and apply the remedy, assuring those so anxious about our co-educated girls that we do not propose to co-educate either boys or girls who need nursing more than educating. Nor do we propose to educate anybody in schools so unhealthy that three or four will be commonly "carried out in a fainting condition." So we protest that such facts from exclusive schools are arguments against such schools, rather than against co-educating schools. The facts simply prove that New York

girls have not the physical ability to sustain themselves in the New York College *for girls only*. It would seem, therefore, to be the part of wisdom for their physicians to attend to their own sick patients, and not be so very solicitious about ours, who are in perfect health. If ipecac makes their patients sick, why not stop the nauseating drug, and not be so alarmed about the iron which makes ours so well. We fail to see the logic of the argument; we can not see why our well girls should take the ipecac which makes theirs so sick, unless we want them to be sick, too. If Drs. Clarke and Winsor could only find one co-educating school with "half the girls sick," and the other half "fainting" and "emotional," they might have an argument against the system.

If they would cure the evil they paint in such vivid colors, let them consult nature, put the boys and girls together, restore them to the companionship the Creator gave them; and I will venture the assertion the girls will so improve, the first year, that the absentees will be reduced one half, and that not even one girl will be carried out in a fainting condition, and that all of them will be far less emotional.

Oh! but that won't do. "The girls are so emotional," especially "at a certain age." Yes, and so are boys, as well as girls, and even men and women, more emotional at all ages *when the sexes are separated.* The experience of monks and nuns, as well as school boys and school girls, prove this.

The sickening statistics of our lunatic asylums, and the startling facts which occasionally come from these exclusive institutions, should lead every parent and every educator to seek some more logical solution of the evil which is sapping the very foundations of our civilization. Volumes might be filled with quotations showing that exclusive education has aggravated rather than lessened the great cause of so much physical debility in the rising generation.

But why do not Drs. Winsor and Clarke give us the sanitary statistics of the co-educating schools they so much condemn? They have hundreds of them scattered all over the East, from the Potomac to the Aroostook. Many of these academies are among the oldest schools of the country, and have co-educated many generations of girls, who never dreamed they were too puny and emotional to sustain themselves in these mixed schools. Please give us the statistics of those schools which educated so many of our noble, gentle and loving mothers. Let us see whether the girls educated in them were so feeble that half of them staid at home daily, and whether the remainder were so emotional that fainting was a common event. The statistics of these venerable academies would be of some service in this discussion.

To enable those discussing this subject to arrive at the true result, I will state a few facts respecting these schools. I have had thirteen years' experience in these old co-educating schools, as pupil and teacher; but I never saw a single girl faint in any one of them. My registers, running through ten years in three of these co-educating schools, show less than three per cent. of absentees. They also show the girls as punctual as the boys, and that they stood quite as high in the scale of scholarship. I do not remember any trouble from emotional girls.

When a pupil in these schools, I found it very difficult to keep even with my beautiful classmates in Physics, Greek, Latin and English.

While waiting for these statistics of co-educating schools, we would suggest to those so solicitous about the girls in our mixed schools, that we will abolish them all when they show any such sad sacrifice of girls as they have reported in the New York Normal College *for girls only*. And, besides, when any of our co-educating schools report half its pupils on the sick list, and that as an average for two years, we will ask the Board of Health to examine its sanitary condition, and, if no remedy can be found, abate it as injurious to the public health; and, where "three or four girls are commonly carried out of one of them in a fainting condition," we will ask the humane to aid us in saving our girls from so cruel a system.

ARCHÆOLOGY.

TRACES OF SOLAR WORSHIP IN NORTH AMERICA.

BY EDWIN A. BARBER.

In an article published in the October NATURALIST, entitled "On the Ancient and Modern Pueblo Tribes of the Pacific Slope of the United States," the writer made use of the following expression: "Both paid homage to the sun, or at least looked for a Messiah daily to come to them from the east," to which assertion exceptions have been taken by some ethnologists.

It is held by this class of scientists that the heavenly bodies were never deified by any of the American races. Granting this to be, in some degree, true: That the luminaries, collectively or individually, were not elevated to the *highest* place in their worship, by any tribe or people in North America, yet the celestial orbs, nevertheless, figured prominently in the list of supreme objects of worship, and many *traces*, at least, of this form of worship are found in the religions of aboriginal races of all ages, from the oldest American people down to the tribes of the present day, especially among those versed in astrology or astronomy.

Although little is known of the Toltecs of Ancient Mexico, it is an established fact that astral worship existed among them. They paid homage to the sun and dedicated their earliest temples to him. The moon, also, they reverenced as his wife and the stars were believed to be his sisters, according to the Mexican Licentiate, Don Mariano Veytia, in his "*Historia Antigua.*" The same writer describes the ruins of San Juan Teotihuacan, the most ancient architectural remains of Mexico, situated about thirteen miles north-east of the capital city. Of these, the largest pyramid, which measured six hundred and eighty feet in length at the base and was estimated at two hundred and twenty feet in height, was dedicated to To-

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natinh or Tonatricli, the sun; the next structure in size and importance was inscribed to Meztli, the moon. On the summit of the former a temple was erected, in which was placed an immense statue representing the sun, which faced towards the east.

According to the accounts of Bernardino de Sahagun, a Spanish writer of the sixteenth century, and one who was particularly cautious in his deductions and entirely reliable in his accounts of the religion of the Aztecs, as set forth in his "Historia Universal de Nevua España," solar and lunar worship occurred in the Aztec religion, the sun with them being a spiritual conception. They believed that the heroes who fell in battle or died in captivity, or women who died in childbirth, were immediately transported into the House of the Sun, where they led a life of everlasting delight. From the broad tops of their *teocallis* or temples, the Aztec priests were in the habit of performing impressive, and, in too many cases, bloody ceremonies, in which the heavenly bodies were made to take a prominent part.

After the fall of the Mexican Empire, traces of sun worship were common. Captain Fernando Alarcon, in the year 1540, mentioned having met, on the Colorado river, Indians who worshipped the sun.

The same custom exists among the modern Pueblo Indians of New Mexico. Lieut. A. W. Whipple says of these people that "they are now anxiously expecting the arrival of Montezuma; and it is related that in *San Domingo* (one of the nineteen Pueblo towns), every morning at sunrise, a sentinel climbs to his house-top and looks eastward, to watch for his coming."

Mr. Whipple also gives a tradition[1] of these Indians which assigns *Acoti* (another Pueblo village, situated on the Rio Grande del Norte, the ancient Tiguex) as his birth-place; but the tale is so at variance with facts and so rich in imagination that it is evidently the invention of some fertile brain. The Spaniards who came among the Pueblos, just after the Mexican conquest, about the year 1539, evidently introduced the name of Montezuma and probably instilled into their minds this idea of his second advent. Thus the worship of heavenly bodies may have become blended with the deification of ancestors; then the sun may have taken the name of Montezuma. Whipple further states that they "smoke to the sun that he may send them antelope to kill, Indians to trade with, and save them from enemies."

Among the Navajos, also, by the same authority, "The sun, moon and stars are sacred, as the authors of seasons of rain and of harvest." He also says of the Zuñians, "Beneath the apparent multiplicity of gods, these Indians have a firm faith in the Deity, the unseen Spirit of God. His name is above all things sacred, and like Jehovah of the Jews, too holy to be spoken. Montezuma is His son and their king. The son, moon and stars are His works, worthy of their adoration."

The "ancient Pueblos" of the Pacific slope of the United States, whose ruined stone structures are found so numerously throughout portions of Colorado, Utah, New Mexico, Arizona, and probably Nevada, held the sun in high

[1] Vol. III, Pacific R. R. Reports.

esteem, at least, if they did not worship it. This is shown in the situation of the houses in many localities. In the Cañon of the Rio Mancos,[1] for example, the dwellings are almost invariably found secreted in the cliffs of the *western* bluff, and from their roofs the inhabitants were wont to salute the king of day as he raised himself above the eastern plateau.

Among the Moqui tribe, to-day, traces of this form of worship still obtain. The religion of their forefathers seems to have degenerated into a mere custom, the origin of which has been long lost sight of in their obscure traditions. Thus, in the course of time, it seems probable, the worship of celestial orbs has given place to hero-worship; solar worship to anthropomorphism, and it is said that the Moquis have ultimately become imbued with the belief that it is a Messiah, in the form of one of their own ancestors, that is, Montezuma,[2] whom they are expecting to arrive from the east. The Moquis and the Pueblos and Zuñis are cognate tribes and doubtless remnants of the ancient Nahuatlac races; hence the similarity of their customs.

As the faint streak of red lights up the low horizon, tall, dark figures appear on the parapets of the seven Moqui towns and remain facing the dawn until the sun has appeared entirely to view. Then the muffled forms drop away slowly and sadly, one by one, for another morn has brought disappointment to the souls of many that have watched so eagerly and persistently for the coming of the great Montezuma. The routine of another Moqui day has commenced; all is bustle and life and the subdued hum of household occupation floats out drowsily on the sullen, sultry air and the sound of the hundred flour-mills (*metates*) grinding steadily on every side, seems, as it issues from the doors and windows of the stone houses, to pause in mid-air like a droning bee. Then scores of busy figures repair with their water-vessels to the verge of the steep bluffs, and disappear in the crevices of the rocks below.

Having presented these facts in support of the assumption that solar adoration entered, to some extent, into the religions of some of the American races, we may sum them up briefly as follows:

1. Fetichism being the commonest form of idolatry, especially amongst the lower races of man, most tribes whose religion is polytheistic, venerate the sun.

2. We can detect vestiges of sun-worship in the ruins of the Toltec and Aztec temples and pyramids and also in the statues which were placed within them.

3. We can observe traces of it in the traditions and observances of savage and semi-civilized tribes at the present day.

4. We notice indications of it in the hieroglyphics or picture-writings of most North American tribes, ancient and modern, in which the sun symbol occurs frequently.

5. Also in the position of ruined stone houses which look toward the east, the larger rectangular buildings of the Pacific slope being built so as to face the cardinal points.

[1] A northern tributary of the Rio San Juan, in the extreme south-western corner of Colorado. [2] Motecuhzuma.

6. Finally, we can observe signs of this worship in the orientation of dead bodies in graves.

If we accept these briefly stated facts, there can be no reasonable doubt that the worship of the sun entered, to some degree, into the religions of the American aborigines; how far, we have not the means of determining; yet, quoting the poet Southey's words,—

> "I marvel not, O sun! that unto thee
> In adoration man should bow the knee,
> And pour the prayer of mingled awe and love;
> For like a god thou art, and on thy way
> Of glory sheddest, with benignant ray,
> Beauty, and life, and joyance from above."

—*American Naturalist.*

PREHISTORIC RUINS IN DADE COUNTY, MISSOURI.

To Mr. W. G. McDowell, we are indebted for the facts pertaining to a remarkable curiosity in Dade county, the existence of which, we understand, is unknown save to a few of our citizens. It lies near the edge of Connor's Prairie, about seven miles northwest of Greenfield, in section 29, township 32 of range 27 west, and about one hundred yards from the edge of the prairie, in the timber, and consists of a perfectly circular line of earthworks three hundred feet in diameter. The ground lies gently sloping to the south, where lies a small ravine shown in the diagram. The northern arc consists of a single ditch and parapet, while the southern portion, overlooking the ravine, consists of two distinct and parallel lines of trenches and embankments of considerable strength, with a third inner line in the central portion, as shown by the cut. On the east and west sides of the enclosure are two openings or entrances in the walls, each about twenty feet across. Here the walls are doubled, the outer ones preserving the circular form, while the inner lines curve inwardly until the ends point to the center of the fortification. In the opening between the termini are situate two mounds, one at each entrance, almost filling the entrances. The walls are five or six feet wide, and though worn now by the rains of centuries, are from two to four feet in height.

In the enclosure is an old well, now partially filled with debris, from which the prehistoric warriors or priests undoubtedly obtained their supply of water.

The ground is covered with a growth of timber, and some large trees are standing on the embankments. That it was the work of a people whose history is unknown to us is evident; but for what purpose and by whom are idle speculations.

The subjoined diagram gives a very correct general idea of its appearance. The object is well worthy of a visit.—*Dade County Advocate.*

THE BLACKWATER, MISSOURI, MOUNDS.

The Warrensburg *News* has an account of the discoveries made by the Normal School students in the recently opened mounds on the Blackwater, near that place, from which we get the following:

The mounds are arranged in the form of a triangle, but are not all of the same size. The most northern one is the largest, and was the first one explored. It is about thirty-five feet in diameter at the base and about five feet high in the center. The vault is 7x13 feet, surrounded by a rude wall of thin limestone slabs, and covered by the same. In the vault were found the remains of seventeen human beings, arranged in two rows of eight each, and the odd one in the middle—the skulls being about one foot apart. The earth was so packed about them that it was difficult to secure bones in perfection, yet a number of jaws, thigh bones, etc., were saved.

About midway of the vault on the south side a pottery jar was found of a capacity of three quarts. The rim has an attempt at ornamentation. Around the neck is the remains of what was a copper band about an inch in width, while around the widest part, at the middle of the jar, is a two-inch band of thin silver. In the northwest corner a similar jar was found, but without the bands. There were also arrowheads, pieces of lead ore, paints, etc., found mixed with the bones, and at the west end were found several stone pipes, some of soapstone, others of bluish sandstone. One was about six inches in length, with the bowl, stem and holder all cut from one piece of stone. Some of the red paint is very soft, and when rubbed on the hand has a peculiar lustrous metallic appearance.

In the other mounds were found flint arrow heads, red ochre and other paints, and round pieces of flint, supposed to be for grinding purposes, and also good sized lumps of lead ore. The teeth in the jaws were all very sound. Several deer horns were also found, and had the appearance of having been used as implements, as daggers, or something of that nature.

The digging was done from the top downwards. The mounds are composed of rather a reddish clay, and is supposed to have been obtained from a locality away from the mounds—"as there are no streaks, layers or other evidence that it was scraped up or gathered from the surface round about. It was not mould."

These are the details as we find them in the *News*. The site of the mounds is upon a beautiful elevated spot, well drained in all directions, and from which a good view of the surrounding country could be had before the present growth of trees obscured it. This growth is of oak and hickory trees of fifty or sixty years' growth.—*Journal of Commerce.*

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A QUARRY OF INDIAN RELICS.

A discovery that will prove of interest to antiquaries has been made in Johnston township, Providence County, R. I. The exact locality is about one hundred yards north of the Killingly Pike, on the Big Elm Farm. Mr. H. M. Angell, of Providence, whilst engaged in quarrying slate at the place above indicated, found a soapstone bed between two slate ledges, about six feet underground. Cartloads of pulverized stone were removed, without any suspicion that it was the debris of an ancient mine. At last the surface of the soapstone rock was reached, and this was so curiously carved as to attract the notice of the workmen, the entire surface being covered with hollows and projections. This was a rock from which the aborigines had carved soapstone dishes and utensils. The method was to cut away the stone from a circular portion till that was left as a projection, and then cut under the projection until it was detached, after which the block thus obtained was hollowed out and became a dish or bowl. The work has been done with knives and hammers of stone, the slate furnishing a sharp edge to cut, chisel and scoop out the soapstone. One of two stone hammers found weighs nearly one hundred pounds, and was hollowed in the middle, probably so as to be bound with thongs to a handle. Already one hundred and fifty cuttings for bowls that were never finished, have been counted in the soapstone. The ledge itself had been cut down by the aboriginal workmen, in its manufacture, several feet below the original level. Large numbers of stone hammers and axes have been found by the explorers. The rock is soft, and some copper, silver, talc and asbestos are associated with the soapstone.

METEOROLOGY.

THE VALUE OF SCIENTIFIC WEATHER OBSERVATIONS.

Three daily observations of weather phenomena are made at eighty-three stations of the Central Pacific and Southern Pacific Railroads and their branches, the area covered by the observations extending through eight degrees of latitude and twelve degrees of longitude. New observing stations are set up in proportion as a new line of road advances. The records of these stations form the basis of a singularly interesting and important paper by Mr. B. B. Redding, which was read at a meeting of the California Academy of Sciences on January 21st. In illustration of the *financial value* of systematic observations of this kind, the author gives two cases where even superficial study of the meteorological records would have demonstrated in advance the inevitable failure of certain enterprises. For instance, in 1869 a large sum of money was expended in covering over some lakes near Summit Station with sheds, under which to cut ice for the San Francisco market.

No sheds of sufficient width could be built that could bear the weight of snow falling at that point, and consequently the undertaking ended in disastrous failure. The meteorological records of the railroad companies show that the average rainfall at this point is over *five feet!* "Nearly all of this falls in the form of snow, and is equal, if the snow that falls did not become compact or melt, to a bank of snow each winter of sixty feet in depth." A similar instance of the value of these records is furnished by the experience of the farmers settled on the west side of the San Joachin river. For years they have tried in vain to raise crops without artificial irrigation. That section of the State of California is an exemplification of the law thus expressed by Guyot, that "when a mountain chain opposes an horizontal wind the air is forced up along the slopes, its vapors are condensed and water the side exposed to the wind, while on the opposite slope the same wind descends into the valley dry and cloudless." The author considers very fully the operation of the chief laws of meteorology as applied to California in general, and to special localities in particular. Among the subjects discussed by him, we would mention the conflict between polar and equatorial winds; the influences of the Gulf of California; the comparative rainlessness of the Colorado and Mohave deserts and the Tulare Valley; the rainfall in the great valleys and on the mountain sides; the influence of the great deserts on temperature and rainfall; why the summer temperature of San Francisco is so low as it is, the mean temperature of summer at the Golden Gate being only 56°.—*Popular Science Monthly.*

KANSAS WEATHER REPORT FOR MARCH, 1878.

PREPARED BY PROF. F. H. SNOW, OF THE STATE UNIVERSITY.

STATION—Lawrence, Kansas. Latitude, 38 degrees, 57 minutes, 25 seconds; longitude, 95 degrees, 16 minutes; elevation of barometer and thermometer, 875 feet above the sea level, and five feet above the ground; rain guage on the ground; anemometer, 105 feet above ground, on the dome of the University building, 1,200 feet above the sea level.

The warmest March since 1868.

Mean temperature 50°.9, which is 10°.86 above the average March temperature for the ten preceeding years. Highest temperature, 81°, on the 23d; lowest, 27° on the 4th; range of temperature, 54°. Mean at 7 a. m.; 44°.34; at 2 p. m., 60°.06; at 9 p. m., 49°.64. There were but four frosts during the month, all of which were very light and caused no damage to fruit Peaches were in blossom on the 15th, cherries and pears on the 25th.

Rainfall, 2.67 inches, which is 0.14 inches above the March average. Rain fell on eight days; there were a few flakes of snow with the rain of the 29th. The entire depth of snow for the season 1877–78 has been but three inches; the smallest amount on our ten years record.

XUM

Wind—S. W., 31 times, N. W., 26 times; S. E., 11 times; N. E., 8 times; E., 6 times; S., 5 times; N., 3 times; W., twice; calm once. The entire distance travelled by the wind was 11,994 miles, which gives a mean daily velocity of 387 miles, and a mean hourly velocity of 16.12 miles. The highest velocity was 50 miles an hour, on the 28th.

Mean height of barometer column, 29.005 inches; at 7 a. m., 29 025 in.; at 2 p. m., 28.982 in.; at 9 p. m, 29.008 in.; maximum, 29.372 in., on the 17th; minimum, 28.519 in.; monthly range, 0.853 in.

The following is a copy of a portion of the daily record of temperature, direction and velocity of wind, face of sky, humidity and rainfall:

Date.	Temperature. 7 a. m.	2 p. m.	9 p. m.	Mean.	Direction of Wind.	Miles of Wind.	Face of Sky.	Mean hu'dity'	Rainfall in inches.
1	44 0	50.5	44.0	45.6	N E	394	cloudy	93.3	1.10
2	42.0	42.5	38.5	40.3	N W	505	cloudy	91.2	0.05
3	34.0	47.5	33.0	36.8	S W	505	clear	65.6	——
4	27.5	53.0	46.0	46.1	S W	707	clear	68.6	——
5	48.5	66.5	48.0	52.7	S W	646	half clear	49.5	——
6	49.5	65.5	48.0	52.7	W	242	clear	55.3	——
7	46.5	69.0	63.0	60.5	S W	303	half clear	2.1	0.55
8	61.5	50.3	47.5	51.7	S	919	cloudy	87.0	——
9	48.5	57.0	47.0	49.8	S E	686	clear	79.0	——
10	38.0	55.0	44.0	45.3	S W	343	clear	70.1	——
11	38.0	64.5	55.5	53.3	S W	132	half clear	62.4	0.10
12	45.0	55.5	45.0	47.6	N W	333	clear	70 4	——
13	40.5	2.5	44.0	45.1	N W	333	clear	64.9	——
14	35.0	57.0	46.0	46.0	N W	222	clear	7.6	——
15	43.0	71.5	57.5	57.3	S W	232	clear	60.6	——
16	44.5	59.5	16.0	49 0	N W	464	clear	61.3	——
17	40.0	57.5	46.0	47.3	N W	202	clear	62.7	——
18	40.5	59.5	52.0	51.0	E	262	half clear	60.9	0.01
19	47.0	77.0	65.0	63.5	S W	313	clear	53.2	——
20	51.5	76.5	60.0	62.0	S W	212	clear	63.3	0.01
21	55.0	63.0	55.0	57.0	var.	222	half clear	72.2	——
22	52.0	67.0	57.0	58 2	E	131	half clear	71.3	——
23	52.0	80.0	64.0	65.0	S W	253	clear	54.1	——
24	44.0	59.5	46.0	48.8	N W	444	clear	63.8	——
25	41.0	65.0	55.0	54.	S E	202	half clear	56.4	——
26	57.5	79.0	64.5	66.3	S W	606	cloudy	61.9	0.05
27	56.0	66.0	48.5	54.7	N E	363	cloudy	76.2	——
28	41.0	63 0	44.0	45.5	N E	707	clear	59.3	——
29	40.0	38.0	30.0	39.0	E	454	cloudy	92.4	0.85
30	37.0	47.0	42.0	42.0	N W	575	half clear	70 2	——
31	35.0	56.0	48.0	46.7	S E	212	half clear	65.2	——

ST. LOUIS METEOROLOGICAL SUMMARY FOR MARCH, 1878.

REPORTED BY WM. FINN, SIGNAL SERVICE U. S. A.

In general: Number of clear days, 13; fair, 9; cloudy, 9; number of days on which rain fell, 13; there were three thunder showers—on the 6th, 12th and 27th, the latter being a succession of heavy showers. A light frost was observed on the morning of the 25th. From the 19th to the 27th the weather was unusually hazy for the season.

Pressure of the air: Highest barometer, 30.285, on the 18th; lowest, 29.404, on the 27th; monthly mean, 29.923; the mean is unusually low, being more than a tenth of an inch lower than the average for March.

Temperature: Highest thermometer, 76°, on the 23d and 26th; lowest, 34°, on the 4th; greatest daily range, 30°, on the 26th; least daily range, 7°, on the 9th; mean of maximum temperatures, 62.6°; mean of minimum temperatures, 46°; mean temperature for the month, 54.2°. There were only five days in the month on which the temperature fell below 40°.

The following table shows the comparative extreme and mean temperatures of March for the years given:

	HIGHEST.	LOWEST.	MEAN.
1871	—	—	50.0°
1872	—	—	39.1°
1873	71°	8°	42.4°
1874	77°	19°	43.1°
1875	79°	12°	40.0°
1876	76°	8°	39.9°
1877	76°	9°	38.6°
1878	76°	34°	54.2°

It will be seen from this that the mean temperature of this month shows the abnormal excess of 12½° above the average.

Rain-fall: The total amount of rain-fall for the month is 2.79 inches, two-thirds of which fell in the first twelve days, and the remainder in the last five. There is a deficiency of nearly three quarters of an inch as compared with the previous seven years. The following is the comparative precipitation in March for eight years: 1871, 1.31 inches; 1872, 2.43 inches; 1873, 2.10 inches; 1874, 4.36 inches; 1875, 4.08 inches; 1876, 6.90 inches; 1877, 3.41 inches, 1878, 2.79 inches.

The wind: Prevailing direction, south; highest velocity, forty miles an hour, from southeast to southwest, on the 8th and 12th respectively; total movement of air for the month, 8,957 miles; mean velocity, 12 miles an hour; south to east winds preceeded rain.

The rivers: Highest stage of water during the month, 22 feet 10 inches, on 12th; lowest, 14 feet, on the 28th and 29th.

THE development of State systems of meteorology seems to make steady progress, as we have received the first monthly report of the Missouri weather Service, organized by Professor F. E. Nipher, under the auspices of the Washington Uni-

versity at St. Louis. The present number of voluntary observers is sixty-five, and it is hoped that at least one in each county will be secured. At the central station Professor Nipher possesses the Dellmann electrometer, used by Dr. Wisliczenus during the past fifteen years, and will soon take up a series of observations on atmospheric electricity, in continuation of those so faithfully made by that observer. It is to be hoped that Professor Nipher's labors will meet with a recognition as generous as his service is hearty and cordial.—*Harpers' Monthly.*

MINERALOGY.

SONOROUS SAND.

DR. JAMES BLAKE.

A short time since Mr. W. R. Frink sent from the Island of Hawaii of the Hawaiian group, to the California Academy of Sciences, a bottle of sand which possesses some peculiar qualities. A sand drift exists there some sixty feet high, and by taking two handsfull of this sand and slapping it together a sound is produced like the low hooting of an owl—more or less sharp as the motion is quick or slow. At the time of the receipt of this sand we gave a description of its peculiarities as detailed in a letter accompanying the gift:

"The bank, which is composed of this sand, commences at a perpendicular bluff at the southwest end of the island, and extends one and a half miles almost due south, parallel with the beach, which is about one hundred yards distant from the base of the sand bank. This sand drift is about sixty feet high, and at the extreme south end the angle preserved is as steep as the nature of the sand will permit. The bank is constantly extending to the south. It is said by the natives that at the bluff and along the middle of the bank, the sand is not sonorous. Sit down upon the sand and give one hand a quick circular motion, and the sound is like the heavy base of a melodeon. Kneel upon the steep incline, extend the two hands and clasp as much sand as possible, slide rapidly down, carrying as much sand as possible, and the sound accumulates as you descend, until it is like distant thunder. In this experiment the sound was sufficient to frighten our horses, fastened a short distance from the base of the drift.

"But the greatest sound we produced was by having one native lie upon his belly and another taking him by the feet and dragging him rapidly down the incline, carrying as much sand as possible with them. With this experiment the sound was terrific, and could have been heard many hundred yards distant. With all the experiments that were made, it seemed the sound was in proportion to the amount of sand put in motion with a proportionate velocity. Another consideration seems requisite, that is, its perfect dryness. The dry sand would sound on

the surface, where six inches beneath it was wet; but if any of the wet sand becomes mingled with the dry, its property of sounding ceased at once. The sand appears to the eye like ordinary beach sand, but ordinary beach sand will not produce the sounds. It has been said that it lost its sonorous properties when taken away from the bank. But I can discover no diminishing of its sonorous qualities, even with the bottle uncorked, and we have had rain frequently, and an atmosphere more than ordinarily moist for this time of year. Perhaps if exposed to a very damp atmosphere it might absorb moisture enough to prevent its sounding."

In order to ascertain, if possible, the cause of the sound produced by this sand, Dr. James Blake has investigated its structure under the microscope, and at the last meeting of the Academy of Sciences, he stated that the facts he had ascertained fully explain the manner in which the sound is emitted. As the grains of sand, though small, are quite opaque, it was necessary to prepare them so that they should be sufficiently transparent to render their structure visible. This was done by fastening them to a glass slide and grinding down until one surface was obtained. This surface was then attached to another slide, and the original slide being removed the sand was again ground down until sufficiently transparent. The grains were found to be chiefly composed of small portions of coral, and apparently calcareous sponges, and presented, under the microscope, a most interesting object. They were all more or less perforated with small holes, in some instances forming tubes, but mostly terminating in blind cavities which were frequently enlarged in the interior of the grains, communicating with the surface by a small opening. Several specimens of what appeared to be minute bi-valve shells were also met with. Besides the elements derived evidently from living beings, these sands contained small, black particles which the microscope showed to be formed principally of crystals of augite, nepheline and magnetic oxide of iron, imbedded in a glossy matrix. These were undoubtedly volcanic sand.

It would be impossible to give more than a general idea of the appearance of this sand under the microscope, except with elaborate drawings. The structure of the grains, Dr. Blake thinks, fully explains the reason why sound is emitted when they are set in motion. The friction against each other causes vibration in their substance, and consequently in the sides of the cavities they contain, and these vibrations being communicated to the air in the cavities, under the most favorable conditions for producing sound, the result is the loud noise which is caused when any large mass of sand is set in motion. There are in fact millions upon millions of resonant cavities, each giving out a sound which may well swell up to resemble a peal of thunder, with which it has been compared, and the comparison, Dr. Blake knows from those who have heard it, is not exaggerated. The effect of rain or dampness in preventing this sound, is owing to the cavities in the sand becoming filled with water and thus rendered incapable of originating vibrations. The chemical composition of the sand, with the exception of the volcanic grains, is calcareous, being completely dissolved by chlorohydric acid, although it is probable that some of the spiculæ in the sponges are silicious.—*Naturalist's Bulletin.*

DIVISIBILITY OF GOLD.

At a recent meeting of the California State Geological Society, Mr. Henry G. Hanks read the following paper on this subject:

Having recently had occasion to refer to statistics showing that gold coin loses an appreciable amount even in a single handling, and being desirous, in connection with my investigations, to examine microscopically the gold dust resulting from such abrasions, I asked Mr. L. A. Boynton, of the United States Treasury, of this city, to brush out the wooden tray in which large sums of gold coin are daily handled, and when he had accumulated sufficient to see the gold, to send it to me. He kindly complied with my request, and I am able this evening to call your attention to some interesting facts, which have developed themselves in the examination.

I have prepared a slide for the society's collection, in which the gold is mounted dry, after first partly removing the impurities with which it was mixed. It will be seen, however, that there still remain coal, sand, fibers of wood and cotton, hairs, etc. In washing out the extraneous matter, the finer particles of gold floated on the surface of the water, and I found it impossible to cause them to sink, although I tried every plan I knew of. This experiment would seem to prove the truth of the oft-repeated statement of miners, that much free gold escapes them from this cause.

On examining the slide under the microscope, it will be seen that the gold is invariably in the form of scales, and much resembles the natural gold scales found on the beach sands at Cape Blanco, except that in the latter the edges and face of the scales are rounded by attrition in being washed about by the waves.

It has been a source of wonder to gold miners that nearly all placer gold is found in flat places. Some ingenious brain theories have been advanced to account for it. The sample I present this evening would seem to indicate some law which governs the form of fragments. I admit I cannot clearly understand how rounded masses of metal like gold coin should react on each other mechanically and produce flat fragments, as shown in the specimen.

To give an idea of the size of the particles of gold, I have measured some of them in decimals of an inch, and I find them to vary from .003x.001 to .0425 x.0235.

I have also measured a large number of the gold scales from Port Orford, and find an average of .0095 in diameter by .00384 in thickness.

The samples were washed from the beach sands found a few miles south of Cape Blanco, on the coast of Oregon. Ten of the scales, selected at random, and melted into a button, weighed .0021327 grammes. From this weight I have calculated the number of such scales which would be required to make up the weight of an ounce troy.

If I have made no mistake in my figures, the number should be 142,468, and yet these gold particles are large as compared with those usually found in quartz.

In collectiong gold from quartz by amalgamation, it has been found that, in most parts of California, any mine producing rock that will yield, by simply milling process, $10 to the ton of 2,000 pounds, and in sufficient quantity to keep a mill constantly running, will pay well to work.

Most of the best paying mines in California do not produce rock in which gold is visible to the naked eye. It requires long search to find a piece of rock showing free gold.

When the tailings of a quartz mill are examined microscopically, the importance of reducing the ore to a state of extreme fineness will be apparent, for if gold is not absolutely free it cannot be collected by mercury.

Recent investigation naturally leads to the opinion that gold in a state of extreme division is omnipresent in the earth's crust. T. Sterry Hunt, in his work, "Chemical and Geological Essays," quotes Sonstadt to show that the sea water on the British coast contains, besides silver, gold in solution, estimated by him to be about one grain to a ton of water. Mr. J. Cosmo Newberry, Chemist of the Geological Survey of Victoria, Australia, has made some very interesting investigations bearing on the divisibility of gold. He found that the water in certain gold mines contained gold. The timber used to support the mine was carefully assayed and in nearly every case was found to contain gold. R. Brough Smyth, Chief of the Survey, came to the conclusion that the gold was precipitated from solution.

Mr. Newberry had reason to believe, from examination of specimens, that gold was being deposited in many mines. He thinks, however, that finely divided gold is held in suspension in mine water, but not in solution. A sample of mud deposited from mine water of a mine, on Hasler's line of reef, Sandhurst, was examined by careful washing, and the heavier particles were found to consist of auriferous pyrites and free gold. The particles of gold were large enough to be recognized by the microscope. They were in irregular flattened grains.

Dr. Oxland, who was formerly Manager of the Borax Lake Company's works, has given a very interesting account of the deposition of gold with cinnabar, free mercury, sulphur, boracic acid, silica, etc., at the sulphur banks situated on the margin of Clear Lake.

He says: "These phenomena present indubitable evidence of the volatility of gold and silver, mercury and iron, in presence of aqueous vapor, associated with sulphureted hydrogen, carbonic acid and boracic acid."

Some years ago, in Calaveras county, an old furnace—used in roasting pyrites preparatory to treatment by chlorination—was torn down, and the roof was found to be coated with cold. A specimen is preserved in the museum of the University of California. Here is proof that gold is volatile at a comparatively low temperature. It has long been known that it is volatile at a high temperature, and advantage is taken of this fact in the purification of platinum.

On the Pacific coast, gold is found in the most unexpected places. There is scarcely a formation which does not contain gold in greater or less quantities. It is also found associated with minerals not usually considered its associates.

To illustrate this fact, I have brought, for inspection, several remarkable specimens:

1. Gold in pyrolusite.

2. Gold in steatite.

3. Gold in calcite. In this specimen the gold is deposited on the wall-rock of the mine, apparently by the same agencies which deposited the calcite.

4. Gold on pyrites. It will be remembered that I exhibited a similar specimen at a former meeting, and called attention to the globules of gold, which seemed to be squeezed out of the crystals of pyrites, or to have been deposited on their surfaces in a manner not easily explained. The specimen I have brought this evening is more remarkable than those formerly shown.

I have long believed that the gold in sylvanite, nagyagite, calverite and other telluric minerals was a mechanical mixture and not chemically combined. Experiments I have made from time to time have convinced me that my opinion was correct. I have prepared a specimen of telluric gold, from Sunshine, Colorado, which is worthy of your attention. You see that the gold is in a state which would preclude the idea that it had been chemically combined with the tellurium, in which case the gold would have been an amorphous powder rather than the semi-crystalline form shown. The specimen has been repeatedly boiled in nitric acid, by which the tellurium has been dissolved.

It must be admitted, from the experience of the last twenty-five years, that gold exists in minute quantities in many rock formations which will not pay to work. On the other hand, many mines, which will scarcely pay at the present time, will become productive as our quartz milling machinery is improved. Much gold is lost in California by unskillful milling.

Although the modern quartz-mill is a marvel of mechanical skill and ingenuity and does its work rapidly and well, yet it has not reached perfection. The problem for the future inventor to solve will be to construct machinery which will reduce the rock to an impalpable powder, to set the gold free and to collect it without mechanical loss of either gold or mercury.—*Sci. Amer. Supp.*

THE FUTURE OF LEAD.

Below we give an extract from the *Engineering and Mining Journal*, of New York, which has some good points in it, but which does not, in our judgement, touch the case in its vital point. Instead of depending alone upon the reduction of the cost of producing and transporting lead as the means of making it profitable to the miner, we must devote ourselves to discovering new uses for this metal. At present it is used principally in the manufacture of paint and of tubing, and for such purposes the demand is exceeded by the supply. A large number of economic uses in building and in the arts may be better subserved by this almost indestructible metal, and the proper degree of attention turned in such directions will avail more in raising the price to a paying point than either the

first named means on the one hand, or passing resolutions and getting up "corners" on the other.

THE PIG LEAD COMBINATION.

"Sales of about 200 tons at $3.75@$3.80 have been made during the week. The market is for the moment higher, being quoted at about $3.85. The cause of this is not on the surface. There is still a large stock held in numerous hands, and although undoubtedly there must come a better demand for the article than prevails now, yet there is nothing to indicate that the production will be less than the consumption. In fact, the indications are that the production this year, like that of 1877, will be greatly in excess of the requirements.

The shipments of pig lead from England to China for the first two months of this year were 1,410 tons, as compared with 2,640 tons last year, and to Japan 572 tons, as against 31 tons for January and February, 1877.

A number of estimable gentlemen who reside at or near St. Louis seem to imagine, as we have several times had occasion to report in these columns, that, by a stroke of the pen, they can regulate the price of lead for the whole United States. They have held meetings and agreed among themselves that the present price of lead is outrageous, and that there is no valid reason why—if they would all say so together—they should not make consumers and dealers everywhere actually believe that lead is not so abundant as they thought it was, and persuade them to pay more for it.

We have before us a circular issued by these gentlemen on March 9, in which they state that they have formed themselves into an "*American Pig-Lead Association*," and they ask all dealers or producers of lead to join the same, and pay for this privilege twenty-five dollars each.

The members who sign the articles of the association bind themselves—under penalty of being turned out of the A. P. L. Association—to sell no lead at a less price than that fixed by the Executive Committee of said association.

Provided, that the lowest cash price for first class corroding lead shall not be less than four cents per pound in New York and that less freight to New York and other points. Other than first class corroding lead to be 15 cents per hundred pounds less than this. The committee to fix prices on the 15th of each month for the succeeding month, and to notify each member of the A. P. L. A.

Provided, that this agreement shall be signed by all producers in the United States who produce annually as much as one hundred tons of lead, and by all persons now holding as much as one hundred tons of lead otherwise than as manufacturers or consumers.

Each member is to consider a notice from the Committee that this agreement has been sufficiently signed, as sufficient, and thereafter he is to do no business below the official rate—or if he does, the Executive Committee will "investigate" him, and expel him from the association.

Any member may withdraw on giving thirty days' notice.

This movement—which is a very faint imitation of the Anthracite Coal Combination—will never pass beyond the stage of a meeting "resolution." The fact is apparent to all outside of St. Louis who have studied the question, that the limi

to the decline in lead will only be found when we find foreign market for our surplus, and no amount of combination can advance prices here till that has been secured. The gentlemen who have "resolved" so many things according to this circular, had better resolve to secure greater economy in production and transportation, and carry into effect the only sensible resolution passed at the meeting referred to, viz: "to investigate the question of immediate exportation of the lead to China and elsewhere." We have reason to believe that some of the largest Missouri works can produce lead at 1¾ cents per pound, and are expecting to make further economy. This of course does not leave profit to the works, but it is sufficient to show that even when the export figure (from 3¼ to 3½c.) is reached, Missouri can still maintain its own in the struggle for the prize.

The rapidly increasing production of argentiferous bullion in Utah, Colorado and Nevada, where the ore is treated for its silver alone, and where the silver is made to pay, in part or altogether, the freight on the lead to St Louis, and even to New York, is an element in the lead market which cannot be controlled by any combination, and which has to be met in a more practical form than a set of resolutions decreeing on paper a minimum price for lead.

This, indeed, seems to us to be the very key to the lead question, and it is pure folly to ignore or belittle it."

INDUSTRIAL NOTES AND MISCELLANY.

SEASONABLE HINTS FOR AMATEUR GARDENERS.

FLOWERS.

This is the month to pay attention to the hardy annuals. The sooner they are sown the finer they will flower; that is, provided they are really hardy. Tender annuals, such as Globe amaranthus, Balsams, &c., rot if they are sown before the weather becomes quite warm. The seedsmen's catalogues usually distinguish these classes for their customers. In sowing annuals the soil should be slightly stirred with a broad-bladed knife or trowel; and after the seeds are sown they should have a little soil sprinkled over them, about one-sixth of an inch deep, according to the size of the seeds; barely enough to cover is all that is required. Failures usually arise from the seeds being buried too deeply. Failures also frequently occur from the soil with which the seeds are covered being too stiff or clayey, "baking" after a rain. Light sandy earth or decayed vegetable loam from the woods should be employed for the purpose. Stick a peg in where the seeds are sown, so that when turning out the plants in May from pots, the annuals will not be disturbed. Also take care to preserve the names of the kinds. This is a great part of the interest in the flower garden.

Walks should now have their spring dressing—the verges cut, and a thin coating of new gravel laid on. Before putting on the new, harrow up the face of the old gravel with a strong iron toothed rake. Roll well after the new is laid on.

This is the proper season to lay down box-edgings. To make them properly the soil along the line of the edge should be first dug, and then trod very hard and firm, so that it may sink evenly together, or the line will present ugly looking undulations in time. Rooted plants should be employed; cuttings are sometimes used but frequently die out in patches; a good edge can rarely be made from them. The plants should set pretty low down, leaving the plants, when set, one or two inches above the soil, according to their stockiness. Sometimes box edgeings are laid around beds formed in grasses. When so, a few inches of clear ground should be kept clean between the grass and the box, or the weeds will be so intermixed with the box, after awhile, as to render it a nuisance.

Herbaceous plants do badly if several years in one place. Every second year, at this season, take up and divide them. Sow as soon as possible some hardy annuals. The earlier they are in the ground after the frost leaves it, the finer they bloom.

Ornamental hedges judiciously introduced into a small place, add greatly to its interest. No easier method offers whereby to make two acres of garden out of one in the surveyor's draught. The arbor-vitæ (Chinese and American), Hemlock, Holly, Beech, Hornbeam, Pyrus japonica, Privet and Buckthorn may be applied to this purpose.

Shrubs are not nearly enough employed in planting small places. By a judicious selection a place may be had in a blooming state all the year; and they, besides, give it a greater interest by their variety, than is obtained by the too frequent error of filling it up with but two or three forest trees of gigantic growth. Plant thickly at first, to give the place a finished appearance, and thin out as they grow older. Masses of shrubs have a fine effect on a small place. The center of such masses should be filled with evergreen shrubs, to prevent a naked appearance in the winter season.

Many things that appear frosted a little at the tops should be severely cut down; it will prevent disappointment in the end. Shoots that are injured in winter—especially in the case of the rose—will often have sufficient vigor left to enable them to put forth leaves, and sometimes even go so far as to attempt to flower, then die off suddenly under the first hot sun.

FRUITS.

Grape-vines on arbors and trellises, should have their pruning finished before warm Spring days set in, or they will bleed. It does not injure them much but it looks bad. The pruning must be regulated by the condition of the vine. If the vines are young and the shoots weak, cut them all back, to make a new and vigorous growth. If already a fair quantity of strong shoots of last season's growth exists, cut out the weaker ones, so as to leave enough of stronger ones. The cane system, slightly modified, is best for arbors and trellises in the hands of

amateurs generally. This implies a new set of canes every year or two. If, as frequently happens from bad management, all the young and strong-bearing wood exists only at the end of the vine,—and these latter have become nothing but long, ropy-looking apologies for what a vine should be—the whole cane may be buried down in the soil to where the strong shoots spring from, and the young wood of last season trained up from this. The plant will then recover its good appearance quite as well as from cutting down, with the advantage of not sacrificing a year's crop of fruit.

Many kinds of raspberries, especially in dry soils, have a tendency to throw up innumerable suckers. These should be thinned out. Three or four canes are enough to leave in a "hill." We like, however, to grow raspberries in rows, where each cane may have a chance to enjoy an independent existence of about a square foot of soil for itself.

We have before remarked that fruit trees and bushes should invariably be cut in severely, and not allowed to bear the same season of planting. It is a fatal mistake to look for fruit the same season of setting out the trees. This is at the expense of future growth, and without future growth there will no future crops.

Raspberries, blackberries, &c., frequently bear and die when so treated. The canes should be cut back to a few inches on transplanting. Raspberries for fruit in fall should always be pretty well cut back. It is not essential with the regular Fall-bearing kinds, but it aids them much.

VEGETABLES.

In the garden we might give a hint in asparagus culture, that if very large stalks are desired the soil must be very rich, and the plants set as wide apart as rows of corn. It is to be observed that those who believe there are some varieties of asparagus that may be reproduced from seed, urge the necessity of planting very wide apart. We do not know that *very* large stalks are especially desirable, and for ordinary use would set the plants about twenty inches apart; about four inches beneath the surface is deep enough to set. Good deep soil is *generally* good; but if in a stiff soil, deepening it for asparagus only makes a *well* into which the surrounding waters drain. It is much better in such situations to plant in raised beds. The alleys between, then serve as surface ditches. Many failures in planting asparagus, arise from this depth of bed, under such circumstances. The plants rot from water about them.

In the open ground Peas and Potatoes receive the first attention. Then Beets and Carrots. Then Lettuce, Radish, Spinach, Onions, Leeks and Parsley. Beyond this, unless in some more favorable latitudes than Pennsylvania, little can be done till the first week in April. There is nothing gained in working soil until it has become warm and dry.

Those who have no Spinach sown in the Fall should do that right away; no amount of stable manure but will be a benefit to it, though guano, in even smallish doses, will kill it. Guano produces excellent Cabbage, mixed with the ground while it is being dug for that crop. Cabbage is ready; and Potatoes are better in

before the beginning of next month, if the ground is not too wet; many plant Cabbage between the Potato rows.

Onions are better put in early, but the ground ought to be dry, and trodden or beaten firm when the sets are planted; the ground ought not to have rank manure—wood ashes and pure undunged loam will alone produce an excellent crop.

To have Turnips good in Spring they must be sown very early; they are hardy, and must be put in as soon as the ground can be caught right.

Parsley delights in a rich gravelly loam, and should be sown very early.

Parsnips, another crop which should receive early attention, also delight in a deep gravelly soil, but detest rank manure.

Lettuce and Radishes continue to sow at intervals.

Herbs of all kinds are best attended to at this season—a good collection is a good thing.

The Carrot will thrive in soil similar to the Beet; lime is an excellent manure for it—we use Long Orange. Celery may be sown about the end of the month, in a bed of very light rich soil, and Tomatoes, Egg Plants and Peppers sown in pots or boxes, and forwarded. It is as bad to be too early with these as too late, as they become stunted.

In vegetable garden culture it must be remembered that we have to operate the reverse of fruit culture. A woody growth is what we require for fruit trees; but we need for vegetables a soft, spongy, succulent character, the very reverse of this. For this end the ground cannot be too deep, too rich, or too much cultivated. The hoe and the rake should be kept continually going, loosening the surface and admitting "air and light," as the old books used to say. There is not only an advantage in this for the direct benefit of the plant, but an early use of these tools keeps down the weeds, and thus we save labor. It is a great thing to be "forehanded" in the weed war.—*Gardener's Monthly.*

APPLES FOR MISSOURI.—A correspondent, evidently of great experience, from Caldwell county, tells the *Rural World:* "If I were to plant out a new orchard of 100 trees, I would make it about as follows: 50 Ben Davis, 10 Lawver, 10 Winesap, 10 Jeneton, 3 Red June, 3 Early Harvest, 5 Maiden Blush, 3 Smith's Cider, 3 Bellflower, 3 Tallman Sweet. For an orchard of 200 trees, I would add 75 Ben Davis, 10 Rome Beauty, 10 Lawver, and 5 Red Astrachan to the above list. For an orchard of 1,000 trees, I would begin with 750 Ben Davis, and the balance in Lawvers, Jenetons, Winesap, etc."

PROGRESS OF PHOTOGRAPHY.

The second of the course of lectures before the Academy of Sciences was delivered last evening, in Association Hall, by Prof. C. F. Chandler, before a large and appreciative audience. The subject of the lecture was "Photography," and Prof. Chandler, in describing the early history of the art, said photog-

raphy is the act of producing pictures by the aid of light acting upon chemically prepared substances. The name is unfortunate, as it is not the light or the luminiferous principle of the sunshine which accomplishes the result. The proper name would be heliography, or sun writing, which was applied by Niepce to the process he invented in 1827, as more proper, but which has not been generally adopted.

The action of the sunlight in effecting chemical changes such as vegetable colors was noticed at a very early day, and it is a well-known fact that it is to the chemical rays of the sunlight that every leaf and blade of grass owes its chemical activity—which enables it to feed upon the water, the ammonia and salts, and elaborate in the great laboratory of nature the vegetable as well as the innumerable other principles which are to serve as food for the animals, and, after their being assimilated and organized into animal tissue, are to give out the power or force which they derive from the sun, which appears in every motion and every involuntary and voluntary act of the animals. If it is true, as has been stated, that the Egyptians employed an indelible ink prepared with nitrate of silver in marking their mummy cases, they must have been fully acquainted with the effect of sunlight in blackening silver salts in contact with chemical matters. Dr. J. M. Hooper, in his "Rational Recreations," published in 1774, gives a method of writing on glass by the rays of the sun with silver salts, employing a proper stencil for the purpose. Dr. Hooper attributes this experiment to Priestley. In 1777 Scheele called attention to the effect of light upon silver salts, and exposed a paper coated with nitrate of silver to the solar spectrum obtained by passing a beam of light through a prism. He found that the action was confined to the blue end of the spectrum, and that it appeared even beyond the yellow, beyond the visible spectrum, while no change took place in the green, the yellow, orange and red portion of the spectrum, thus demonstrating the fact that the rays which produce chemical decomposition were not identical with the luminiferous rays, and that they are most abundant at the more refrangible end of the spectrum. It has been claimed that Matthew Boulton and his partner, James Watt, actually obtained sun pictures at their works in Soho, near London, as early as 1799—perhaps even before 1791; but the evidence is somewhat uncertain.

THE FIRST IMPERFECT SUN PICTURE.

The first well-authenticated attempts to produce pictures by means of the sunlight were made in 1802 by Thomas Wedgewood and Sir Humphrey Davy. They moistened paper with nitrate of silver and exposed it to the sunlight under leaves and openings of glass such as are used in magic lanterns. They even took profiles. Davy succeeded in obtaining pictures with the solar microscope, but neither of these chemists was able to prevent the unchanged portions of the pictures from becoming colored when they were exposed to the diffused light; consequently their pictures were preserved in dark closets and examined with the aid of a candle. In 1814 Joseph Nicephore Niepce, of Chalons, studied the action of light upon asphaltum and other resinous bodies. He coated metallic plates

with asphaltum, and then exposed the image in the camera obscura. The asphaltum was rendered insoluble by strong lights, while in the shaded parts of the surface it retained its solubility. By washing it with oil of lavender the unchanged asphaltum was removed, and the metallic surface exposed was etched with the acid. Finally, in cleansing the plate, the etching was obtained from which pictures could be printed in printers' ink.

THE DAGUERREAN PROCESS.

In 1823 Louis Jacques Maude Daguerre, of Brie on the Marne, began experiments, seeking to fix the pictures in the camera, which he produced with chloride or nitrate of silver for his sensitive salt. He does not appear to have been any more successful than Wedgewood and Davy. In 1827 Niepce communicated his process of heliography or sun sketching to the Royal Society, exhibiting some of his prints from the etched plates I have just alluded to. This led to his acquaintance with Daguerre, and they continued their investigations together until the death of Niepce in 1833, and from this date the work was continued by Daguerre and Isador Niepce, the son. In January, 1839 Daguerre announced the discovery of the beautiful process which bears his name, and which took the world by surprise. When the word was first brought to this country that two French chemists had succeeded in fixing the image seen in the camera-obscura indelibly upon a silver surface, almost every one was incredulous. The moon hoax which was published in the New York *Sun* in August and September, 1835, which gave most graphic descriptions of what Lord Rosse had seen with his great telescope at the Cape of Good Hope, and from which it appeared that the moon had a vast population of human beings, whose habits, manners and mode of life were so graphically described by Locke, was still fresh in the minds of most Americans, and they looked upon the discovery of Daguerre and Niepce as simply another effort of Mr. Locke or some other equally ingenious writer.

There was one man, however, in America, who was not incredulous. John W. Draper, of New York, had been investigating the action of light, and had used pieces of paper rendered sensitive to silver salts in his investigations. He was quite prepared, therefore, to believe in the possibility of achieving all that Daguerre claimed, and immediately began experiments upon the meager information which came with the first announcement of the discovery.

Not only was he successful in accomplishing all that had been claimed that Daguerre had done, but, from his knowledge of the business and familiarity with optical apparatus, he was able to make important improvements in his little laboratory in the University.

FURTHER PROGRESS DESCRIBED.

After elaborating somewhat further the history of the various processes which have been introduced from time to time, the lecturer alluded to the painful ex-

perience of the early sitters in Dr. Draper's laboratory, where the first daguerreotypes of the human face were taken with their faces floured and blue lights streaming down upon them for fifteen or twenty minutes. He then gave a description, illustrated by specimens, of each of the new important processes. The Daguerrotypes which were so extensively taken twenty or thirty years ago, were exhibited, and the processes by which they were produced fully described. The daguerrean process, he said, had recently been revived in Brooklyn by the skillful operator Frank Pearsall, and with very great success. Some of his pictures by this process were exhibited by the lecturer.

TALBOT-TYPES EXPLAINED.

He next described what was meant by Talbot-types, invented by Henry Fox Talbot in 1839, and some of these were exhibited, the lecturer having been fortunate in securing a series both of negatives and positives from Mr. Rapp, of this city, who procured them many years ago at Frankfort-on-the-Main. These pictures were especially interesting, as they first suggest the idea of a negative for preparing a positive; and, although owing to the imperfections of the paper and the fact that much had to be learned, they were not very beautiful, still they formed one of the most interesting topics of the lecture.

Photographs without the camera were next exhibited. Ferns impressed upon sensitive paper after the methods employed by Davy and Wedgewood, but rendered permanent or fixed by the use of hyposulphate of Soda, a process which the lecturer said three distinguished chemists would have given a great deal to have known.

COLLODION PICTURES.

Collodion pictures were next noticed. Herschell had endeavored to make use of glass plates coated with silver salts for the production of negatives as early as 1840; Niepce de St. Victor first succeeded in using them, employing a film of iodide of starch, sensitized with nitrate of silver. Later, in 1847, he used iodized albumen films, but it was not until Schönbein discovered gun cotton in 1846, and its solution in alcohol and ether called collodion, was introduced by Scott Archer in 1851, that photographs now prepared with the aid of negatives became of any importance. This process has now become the key to all the various processes employed for producing silver prints, carbon prints, Albert types, heliotypes, photographs, electrotypes, lithographs and engravings.

The processes with collodion were described by the lecturer in detail. Negatives were taken before the audience, with the aid of the electric light, and were then fixed in their presence, and with them glass positives were at once printed. A beautiful series of very large silver prints was exhibited and explained, as well as a silver print of the moon photographed by Mr. Lewis Rutherford of this city, and also the moon photographed by Dr. Henry Draper, and with it the photograph of the solar spectrum, and his latest photograph, proving the presence of the free oxygen atmosphere of the sun. Large solar prints by Golder & Robinson were also exhibited, as well as micro-photographs from Philadelphia.

A series of transparencies photographed by Mr. Landy, the assistant in chemistry at the School of Mines, was shown in the magic lantern. These, the lecturer said, were extensively used at Columbia College, for illustrating the lectures.

AUTOTYPES.

Prof. Chandler next called attention to gelatine transfers called "autotypes." This wonderful process, he said, was invented by Swan, of Newcastle, England, and had been brought to a high state of perfection by Leon Lambert, of Paris. The subject was illustrated by a complete series of specimens, beginning with a silver negative and ending with a finished picture made by Lamson, of Portland, who received the prize for this class of pictures at the last public exhibition. Specimens of these pictures by Rockwood, of this city, and Adolph Braun, of Dormach, Germany, as well as a beautiful series of transparent gelatine transfers for the magic lantern by Levy, of Paris, were shown. Pictures in Prussian blue, prepared by C. L. ———, were next exhibited and explained.

THE ALBERT-TYPES.

The Albert-types, the invention of Albert of Munich, were next explained in detail, and a fine series of specimens, some prepared by Albert himself and others by Edward Bierstadt, of this city, were shown. This process, the lecturer said, begins with the silver negative, from which the gelatine relief is produced, which is placed in the printing press, and will deliver 400 impressions a day in printer's ink, which cannot be distinguished from the best photographs in silver. This process possesses one great advantage over almost every other process in which printer's ink is employed, in that it does not depend upon the picture possessing lines, but will yield from any good negative of the human face a most beautiful and highly satisfactory picture in printer's ink.

PRODUCING PICTURES IN COLORS.

Perhaps the most interesting feature of the lecture was the Professor's announcement that Albert, of Munich, had succeeded in producing pictures in colors by the aid of this process. By the kindness of Edward Bierstadt, he said, he was able to exhibit pictures in three colors produced by the aid of the photograph by Albert, of Munich. The principle was, after all, very simple. The colored picture or landscape is thrown into the camera through a colored screen. It includes all that is yellow and all that is red. There is thus produced a silver negative of everything in the picture which is blue. This is transferred to the Albert-type plate with the aid of blue ink, and all the blue parts of the picture are printed upon the paper. The experiment is then repeated, except that by the use of a different screen and an Albert-type plate all that is yellow in the original picture is secured from this with yellow ink, and the yellow parts of the picture are printed upon the same sheet of paper. The third Albert-type then prepared in the same manner for the red portion of the picture, and these in turn are printed on the same sheet of paper in red ink. Thus the Albert-type is produced by the

combination of three primary colors, which faithfully presents the contents of the original picture. The specimens exhibited by the lecturer were truly remarkable.

The Woodbury-type was next spoken of. In this process the gelatine film is produced in silver negative, which is afterwards dried and forced by hydraulic pressure to make its impression over a thick plate of lead. From this plate, in a proper press, pictures in gelatine, colored by pigment, are actually moulded either in glass or paper. Specimens of both kinds were shown, which, for their colorings and brilliancy, were remarkable.

The next process explained was the photo-gravure. which Prof. Chandler said carried the same principle one step further. The leaden plate is subjected to the galvano-plastic process, and an electrotype copying plate is produced, which is then placed in a printing press and employed in printing pictures in ordinary printing ink. A beautiful series of these pictures prepared by Goupil & Co., was astonishing for their very large size, some of them being three feet by four, and also for their beautiful brilliancy and clearness.

PHOTO ENGRAVING.

Photo-lithography, photo electrotypes, photo-zinc etchings and photo-engraving, were fully elaborated by the lecturer. In relation to the latter, he said it seemed as though the photo-lithograph and the photo-electrotype had reduced the art of reproducing the work of the artist ready for the printing press to its simplest expression, but photo-engraving carried it in point of cheapness to the verge of absurdity. He showed a steel engraving of a beautiful Magdalene, a silver negative and plaster mold, a stereotype plate and copper electrotype, all ready to adorn the page of any of the daily papers, and said that when the engraving was produced and placed side by side with the original, it was almost impossible to decide which was the $10 steel engraving and which the 10-cent or perhaps 5-cent reproduction. At the conclusion of his lecture Prof. Chandler was heartily applauded. —*New York World.*

THE PROCESSES OF MINTING.

The capacity of the various coining Mints and Assay Offices in the United States will be fully tested during the coming year. The law of February 28, 1878, demands that between 2,000,0000 and 4,000,000 of the new dollars shall be turned out every month. The officers of the Mints think that 3,000,000 will be the maximum of production for the present, and to coin as many silver dollars as that a month will require brisk work at the Mints. On the 11th of December last eleven tons of silver were sent to Philadelphia from the Assay Office in this city; seven and a half tons were sent on the 31st day of the same month, and at least twelve tons more have been sent during the last fortnight. Most of the silver received at the Philadelphia Mint passes through the New York Assay Office. There are two coining Mints besides the one in Philadelphia, one in San Francisco and the other in Carson City, and assaying and refining are done

in Helena, Montana; Boise City, Idaho; Denver, Colorado; and at a few other points in the far West. The Philadelphia Mint is capable of turning out about $1,500,000 in coined money a month; the San Francisco Mint $1,000,000, and the Carson City Mint $500,000. The Mints cannot of course, be given over exclusively to the coinage of silver dollars. The subsidiary coins must be struck, and a certain amount of gold coinage goes on all the time. Gold is needed by the Government to buy silver with, aside from all other purposes. It is coined mostly in the form of double eagles. During last month 21,210 double eagles were coined in Philadelphia, and 20 eagles, 20 half-eagles, 20 three-dollar pieces, 20 quarter-eagles and 20 one-dollar pieces were coined in the same time. The other coinage of the Philadelphia Mint during February comprised 200 trade dollars, 375,000 half-dollars, 1,461,800 quarter-dollars, 209 twenty-cent pieces, 964,200 dimes, 600 five-cent pieces, 600 hundred three-cent pieces and 910,800 cents.

Silver is sent from the Assay Office to the Philadelphia Mint pure, or 999 fine, which is about as pure as can be. It is sent in large bars, and, when received at the mint, is melted and alloyed with copper. Coin silver is 900 fine. After being melted and alloyed, the metal is cast into ingots, which are simply bars of a convenient size for handling. The metal is then assayed to determine whether it is exactly of the standard fineness. Assaying is done by what is known as the dry or humid process. Sample for assay are taken while the silver is in a fused condition, and two assays are made of every specimen. The silver ingots then go to the coiner. They are first rolled into strips, and as the rolling process is apt to make the metal brittle, it is annealed to soften it. Silver is annealed simply by heating in an open wood fire, and then being allowed to cool gradually. The silver dollar strips are passed through the rolls nine or ten times before the first annealing and four or five times afterward. Then the process of annealing is repeated. After the last annealing the strips are run through cutters which divide them into drafts of the proper thickness for the coins; and these in their turn are run through a steam punching machine which cuts planchets the proper size for the coin. From 150 to 240 are cut in a minute. As the metal gets greasy during this pro ess, the planchets are then dipped into a bath of diluted sulphuric acid, which is too weak to act upon the surface, but effectively removes all foreign matter. The planchets are then adjusted; that is to say, they are carefully weighed, and all that are lacking in weight are cast aside; such pieces are called "lights," and the "heavies" are the pieces which weigh too much and are filed off. The adjusting is done by women. It is a process which requires much delicacy, and scales are used which are sensitive to one sixty-fourth of a grain. After the adjusting is finished, the next operation is milling, which is done with a curious sort of machine. The edges of the coin are thrown up and grooved by this process. After another cleaning with sulphuric acid the coins are ready for the die. The stamping is done on a screw press, and both sides of the coin are stamped at the same time. The dies are cylindrical blocks of steel, upon which are carved the designs to be transferred by pressure to the coins. Art of

a high order, as well as fine mechanism, is conspicuous in this part of the coining process. The designer, in the case of the new silver dollar, Mr. Morgan, first draws his design on paper, from which is made a model in wax, of which a plaster cast is taken, and from this cast an electrotype is taken, upon which careful revision is made with the graver. This electrotype, like the model and cast which preceded it, is three or four times larger than the impression which appears on the dollar. The design is transferred to a steel die by using Hill's reducing machine, constructed on the principal of the pantograph. One arm of this instrument, with a blunt point, follows the lines on the electrotype, while the other arm, to which is attached a strong and rapidly revolving drill, reproduces the same lines on a smaller scale upon a steel block. By means of a press this impression is transferred to another block in intaglio and thence upon another block, which is the parent die. After each transfer the lines are carefully improved with a graver. Steel of the same quality as that of which the parent die is made is used for the coining dies. They are annealed, and trued on both ends. Two or three blows in the screw press, which is worked with a large wheel, secures a perfect impression, and both the obverse and the reverse of a coin are struck at once. Machinery places the planchets between the dies, and afterwards drops the completed coin in a box. Two or three pieces of each coinage are reserved for the annual Government assay.

The process of melting, refining and assaying gold and silver are carried on in the Assay Office, in this city, on quite as large a scale as at the Philadelphia Mint. Not only Government work is done here, but large deposits are made daily of gold and silver bullion by private individuals. Gold is always found alloyed with silver, and it is never found with any other alloy. To separate the silver from the gold, the bullion is boiled in sulphuric acid, which removes the the alloy; the gold is then reboiled and reduced to a coarse powder resembling clay. Its purity then is 998 or 999. The silver, mixed with copper, is run into vats on a lower floor, and is purified and granulated, when it resembles pipe-clay. The granulated gold and silver are pressed into large cheeses in a hydraulic press. A cheese of gold, twelve inches in diameter and three inches in thickness, is worth $20,000; a silver cheese of the same size is worth $900. The sulphuric acid, after it is used, produces a sediment of blue vitriol, which is much prettier than either the gold or silver seen in the Assay Office. The vitriol and the weak acid are both sold for as much money as the original acid costs. The substitution of sulphuric acid for nitric has caused a saving to the New York Assay Office alone of $100 000 a year. Depositors receive their gold and silver seperately at standard purity, 900. Pure metal is also sent to the Assay Office from the various refineries to be alloyed. From United States refineries silver is generally sent in large bars or cakes, and a small amount of Mexican metal is received in thin, irregular-shaped pieces called disks. The fumes from the vats and furnaces in the Assay Office are condensed and sold as weak acid. Only a small amount of the gas escapes into the atmosphere, and although it is slightly offensive, it is not injurious. On the contrary, this gas is an excellent disinfectant, and acts upon

dead matter rather than living. The same precautions are taken to prevent loss in the Assay Office as in the great mints. The ashes, the sweepings from the floor, the crucibles and all the instruments which come in contact with the precious metals are washed and ground in a machine constructed for the purpose, and the stray particles of silver and gold are gathered together.—*N. Y. Times.*

IMITATION MARBLE FOR MANTELS.

We are enabled to lay before our readers some additional definite details of the art of imitating fancy marbles for ornamentation.

The best material is slate, which possesses the advantage of low cost, ease of sawing and working, and fine grain. The slate comes from Vermont in the shape of slabs about an inch thick, roughed to the sizes and forms most used. The outlines are cut with a bandsaw. Marble is inferior for "marbleizing," on account of its cost and coarser grain.

The grain of slate runs in planes parallel with the flat surfaces, while marble is open and porous, and requires more coats of pigment. Rubbing and smoothing are performed in a horizontal cast-iron wheel, about 10 feet in diameter, running about 57 revolutions to the minute. For marble coarse-grit sand is used; for slate a very fine grit. After smoothing, any channels that are to be made are cut with a rotary diamond cutter, the bit being hollow and rotating about 5,000 times per minute, a stream of water passing through it preventing injury to the diamonds by heating, consequent on friction.

The channel in a "half front" is cut in about three minutes; by hand it would take one man an hour. The arm carrying the bit is heavily weighted, to ease the operator and cause greater steadiness of cut. Channels having acute angles or sunken bevels must be cut by hand, as must some irregular designs. The inner curve of the front is worked to a true line if a fire-board is to be set in, otherwise the the frame of the heater will cover any trifling irregularity, The slab being worked to the required outline and surface, is now ready for marbleizing. The ground is mineral color, ground in copal varnish, because this is a quick dryer. The ground is generally black or brown. When dry, it is ready for the veining or pattern. Upon the surface of a tank of water various colors mixed in oil are spread in peculiar characteristic patterns, these varying according as the color is ground, dropped or sprinkled on, and stirred, fanned, or otherwise mingled and intermingled. The colors do not blend. A slab being dipped edgewise in the water, is brought up so that the variegated film adheres to its surface, making the marble pattern.

The marble slabs are put in a steam kiln and kept at from 185° to 210° Fah. for 12 hours, baking the colors thoroughly. They are next coated with copal varnish, and again kiln-dried; then rubbed down with pumice-stone powder, again varnished and dried, and then rubbed with the finest polishing powder, and then with the hand, when they have a high, rich luster, and are ready to be shipped or to be put together by clamps, etc., in place.

XUM

There are about nine standard marbles which are imitated, about six or seven occasionally selected, and about six or eight odd patterns very rarely called for. Mexican onyx has, as yet, baffled the ingenuity of those who are interested in this branch of business. It is stated that the Tennessee marble is the hardest to imitate, and the Sienna the next. These are not done by dipping, as they are not veined patterns, but are produced by hand-work, somewhat as follows. To imitate Tennesse the slab is grounded in a reddish-brown color mixed in copal varnish; this color is dry in half an hour, and is then spotted with the same color, made lighter with white or darker with burnt umber, until it is covered with spots, which sink into the ground color and present a somewhat blurred appearance. When this is perfectly dry, (which will be the next day), take white paint mixed in water, and coat the slab with it, take a sponge and soak up some of the paint, and the balance will be in small white spots as in the natural marble. The blurred appearance underneath will look like various stones thrown and mixed together.

To make red Pyrenese the slab is grounded in varnish and color, as for dipping, but instead of oil colors, water colors are used. For one peculiar pattern, the slab is (after black ground) coated with brown water color, which is next partly removed by touching with a handful of thin muslin strips. These absorb the color, and leave bare places of peculiar outline. White color is then dipped on with a sponge, and runs on the cleaned places only, giving it a pattern which could not be obtained by dipping, or in any other way. The use of water colors gives a peculiar pearly or transparent effect, needed in the imitation of conglomerate stones, and by them it is hoped to imitate even the now inimitable Mexican onyx.

Where there are panels to represent various marbles on one slab, they are separated by cut lines, which are either filled with gold size, or otherwise used to act as boundaries. The veining of one stone should not appear continuous in an adjacent panel representing another kind of stone; this is a common fault and is in part remedied by leaving a wide unveined band or channel between the panels. Where there is a small veined panel, or a series of such, on a plain black ground, the panels are first colored by dipping or hand-work, and the surrounding surface is colored with a brush.

If the general surface is veined, the panels are first made, and then covered with paper; the whole slab is then dipped, and the panels are protected by the paper. We should mention that an expert dipper can prepare the films and dip 400 square feet of slate (about 150 slabs) in five hours.—*Manufacturer and Builder.*

To Preserve Fresh Fruit.—Mr. Antonio dal Piaz recommends to place the fresh, sound fruit into a solution of sugar, made by dissolving in one litre (about 34 fl. oz.) of water 100–500 grammes (3½ to 17½ oz.) of sugar—the quantity varies with the acidity of the fruit—and 2½ to 3 grammes (40 to 50 grains) of salicylic acid. Cherries, currants, blackberries, grapes, pears, gooseberries, etc., may thus be preserved, even in loosely covered vessels, without injuring the natural aroma.

COMPARATIVE ILLUMINATING POWER OF GAS AND ELECTRIC LIGHTS.

The Electric Light company, of Paris, has erected a large frame building for the purpose of exhibiting the illuminating power of Jablochkoff's electric candle, and comparing its result with those of coal-gas. A correspondent of the *American Manufacturer*, having attended an exhibition, gives in that journal a very good account of his observations. The hall in which the experiments are made is, he says, about sixty feet long, forty wide, and twenty-five high. The walls and ceilings are white. From the latter were suspended three chandeliers, the central one having three "opalized" glass globes about one and a half foot in diameter—each surrounding an electric candle. The other two chandeliers were ordinary gas lustres, each with sixty bat-wing burners. The latter alone were lighted when the correspondent entered the hall, but they amply sufficed to illuminate it. Soon the gas was suddenly turned off, and six electric candles were lighted. Of these, three were on the central chandelier, and the others on three pillars in different parts of the room. Although all these lights were surrounded by large "opalized" globes, the difference between the two illuminations was remarkable. These six candles gave a light much more intense and "whiter" than the 120 naked gas jets. The eye experienced but little more fatigue in regarding the globes sifting the electric light, than it does in looking at the ground-glass globes of single gas-burners. On one of the walls of the illuminated hall was a series of silk specimens of all colors and tints, some of the shades being very delicate. Near by was the notice, "The electric light does not alter colors." This statement seemed to be verified by the experiments. At any rate, the smallest difference of tints were easily distinguished, after a time the gas was relighted, but, notwithstanding its great brilliancy at first, its light now seemed quite feeble, and of a dirty-yellow color, as compared with the electric illumination.

The cost of electrical illumination is estimated at from one-half to one-third the price of gas, for equal quantities of light.

ENGRAVING ON GLASS BY ELECTRICITY.

M. Planté the inventor of secondary batteries, by means of which a large quantity of electricity may be accumulated, has just discovered an excellent means of engraving on glass. Having remarked that a glass tube traversed by a platinum wire serving as electrode to a powerful voltaic current was instantaneously spread out in the form of a cone or funnel, in the midst of an alkaline solution contained in a voltameter, he made a series of experiments to determine what alkaline solution required the least electric force for devitrification. He therefore thought out the following process, which has given some remarkable results:

The surface of a plate of glass is covered with a concentrated solution of

nitrate of potash, by simply pouring the liquid over the plate laid horizontally in a shallow saucer. Then into the liquid which covers the plate of glass is introduced a horizontal platinum wire, connected at one end with the edge of the glass plate and at the other with the poles of a secondary battery of fifty or sixty elements. Now taking in the hand the other electrode, (formed of a platinum wire surrounded everywhere except at its extremity with an insulating sheath), the surface of the immersed glass is touched with it at the points where it is wished to engrave. Wherever the electrode touches, a luminous furrow is produced; and, whatever be the rapidity with which the writing or drawing is done, the traces made are found clearly engraved on the glass. If the writing or drawing be done slowly, the traces are deeply engraved; as to their width, that depends on the diameter of the wire serving as electrode; if it be sharply pointed the traces may be made of exceeding fineness. Either electrode may be engraved with, but the negative requires a weaker current.—*Manufacturer and Builder.*

STEAM HEATING OF TOWNS.

The experiment of heating Lockport, New York, by steam, by the "Holly system" initiated there at the beginning of the present winter, has proved successful. By three miles of pipe, covered with non-conducting material, and laid under ground through some of the principal streets, about fifty dwellings and other buildings, including a large public school, "have been thoroughly warmed all winter by steam thus distributed, and turned on or off as required by the tenant, with the facility of water or gas." It is stated that dwellings more than a mile distant from the steam generator have been heated as readily as those next door. Steam metres are provided, so that the consumer pays only for what he consumes, and the rates, it is asserted, do not exceed the cost of coal and wood under the old system of heating by fires. It is claimed that the system can be developed so as to furnish steam "at fifty pounds pressure, transmitted through twenty miles of pipe, thus supplying power for engines and manufactories, and steam for cooking and laundry purposes, for extinguishing conflagrations, for cleaning streets of ice or snow, or protecting hydrants from frost."

STARCH GLOSS.—This may be prepared as follows: Melt together 4 parts of pure stearin and 6 parts of paraffin, and pour the liquid into a cold form to solidify, then cut the mass into pieces weighing about one-fourth ounce. Having made a lot of starch-paste, say from one pound of starch, one of these pieces is added and left in the mass during a few minutes' boiling. When using unboiled starch-paste, a small quantity of a hot solution of starch containing the gloss is applied to a rag, and the latter gently rubbed over the fabric just before ironing.

THE ROMANCE OF ACCIDENT.

Many of our most important inventions and discoveries owe their origin to the most trivial circumstances; from the simplest causes the most important effects have ensued. The following are a few culled at random for the amusement of our readers:

The trial of two robbers before the Court of Assizes of the Basses-Pyrênées accidentally led to a most interesting archæological discovery. The accused, Rivas a shoemaker, and Bellier a weaver, by armed attacks on the highways and frequent burglaries, had spread terror around the neighborhood of Sisteron. The evidence against them was clear; but no traces could be obtained of the plunder, until one of the men gave a clew to the mystery. Rivas in his youth had been a shepherd-boy near that place, and knew the Legend of the Trou d' Argent, a cavern on one of the mountains with sides so precipitous as to be almost inaccessible, and which no one was ever known to have reached. The commissary of police of Sisteron, after extraordinary labor, succeeded in scaling the mountain, and penetrated to the mysterious grotto, where he discovered an enormous quantity of plunder of every description. The way having been once found, the vast cavern was afterward explored by *savants;* and their researches brought to light a number of Roman medals of the third century, flint hatchets, ornamented pottery, and the remains of ruminants of enormous size. These interesting discoveries, however, obtained no indulgence for the accused (inadvertent) pioneers of science, who were sentenced to twenty years' hard labor.

The discovery of gold in Nevada was made by some Mormon immigrants in 1850. Adventurers crossed the Sierras and set up their sluice boxes in the cañons; but it was gold they were after, and they never suspected the existence of silver, nor knew it when they saw it. The bluish stuff which was so abundant and which was silver ore, interfered with their operations and gave them the greatest annoyance. Two brothers named Grosch possessed more intelligence than their fellow-workers, and were the real discovers of the Comstock lode; but one of them died from a pickaxe-wound in the foot, and the other was frozen to death in the mountains. Their secret died with them. When at last, in the early part of 1859, the surface croppings of the lode were found, they were worked for the gold they contained, and the silver was thrown out as being worthless. Yet this lode since 1860 has yielded a large proportion of all the silver throughout the world. The silver mines of Potosi were discovered through the trival circumstance of an Indian accidentally pulling up a shrub, to the roots of which were attached some particles of the precious metal.

During the Thirty Years' War in Germany, the little village of Coserow in the island of Usedom, on the Prussian border of the Baltic, was sacked by the contending armies, the villagers escaping to the hills to save their lives. Among them was a simple pastor named Schwerdler, and his pretty daughter Mary. When the danger was over, the villagers found themselves without houses, food, or money. One day, we are told, Mary went up the Streckelberg to gather black-

berries; but soon afterward she ran back joyous and breathless to her father, with two shining pieces of amber each of very great size. She told her father that near the shore the wind had blown away the sand from a vein of amber; that she straightway broke off these pieces with a stick; that there was an ample store of the precious substance; and that she had covered it over to conceal her secret. Amber brought money, food, clothing and comfort; but those were superstitious times, and a legend goes that poor Mary was burned for witchcraft. At the village of Stümen, amber was first accidentally found by a rustic who was fortunate enough to turn some up with his plow.

Accidents have prevented as well as caused the working of mines. At the moment that workmen were about to commence operations on a rich gold mine in the Japanese province of Tskungo, a violent storm of thunder and lightning burst over them, and the miners were obliged to seek shelter elsewhere. These superstitious people, imagining that the tutelar god and protector of the spot, unwilling to have the bowels of the earth thus rifled, had raised the storm to make them sensible of his displeasure, desisted from all further attempts to work the mine.

A cooper in Carniola having one evening placed a new tub under a dropping spring, in order to try if it would hold water, when he came in the morning found it so heavy that he could hardly move it. At first the superstitious notions that are apt to possess the minds of the ignorant made him suspect that his tub was bewitched; but at last perceiving a shining fluid at the bottom, he went to Laubach, and showed it to an apothecary, who immediately dismissed him with a small gratuity, and bade him bring some more of the same stuff whenever he could meet with it. This the poor cooper frequently did, being highly pleased with his good fortune; till at length the affair being made public, several persons formed themselves into a society in order to search farther into the quicksilver deposits, thus so unexpectedly discovered, and which were destined to become the richest of their kind in Europe.

Curious discoveries by ploughmen, quarrymen and others, of caves, coins, urns and other interesting things, would fill volumes. Many valuable literary relics have been preserved by curious accidents, often turning up just in time to save them from crumbling to pieces. Not only mineral but literary treasures have been brought to light when excavating mother earth. For instance, in the foundations of an old house, Luther's "Table-Talk" was discovered "lying in a deep, obscure hole, wrapped in strong linen cloth, which was waxed all over with beeswax within and without." There it had remained hidden ever since its suppression by Pope Gregory XIII The poems of Propertius, a Roman poet, long lurked unsuspected in the darkness of a wine cellar, whence they were at length unearthed by accident, just in time to preserve them from destruction by rats and mildew. Not only from beneath our feet but from above our heads may chance reveal the hiding places of treasure-trove. The sudden falling in of a ceiling, for example, of some chambers in Lincoln's Inn, revealed the secret depository of the Thurloe state papers.

MEDICINE AND HYGIENE.

HOME-MADE MINERAL WATERS.

A writer in the *Medical Press and Circular* says: At my instigation, some of my medical friends have used the following mixture where the bitter saline purgative waters of Friedrichshall and Hunyadi Janos were indicated, with equal if not more satisfactory results in abdominal diseases, hepatic congestion, even attended with hemorrhoids, plethora, etc.:

Sulphate of soda	3 drachms.
" " potassa	3 drachms.
" " magnesia	4 drachms.
Bicarbonate of soda	1 drachm.
" " potassa	1 scruple.
Water	20 ounces.
Muriatic acid	1 drachm.

Mix. The bottle is to be kept well corked, and in a cool place.

A wine-glassful the first thing every morning, in a tumbler of cold water. The addition of the muriatic acid answers a twofold purpose: it saturates the mixture with carbonic acid gas, making it more palatable, and the small quantities of chlorides it generates adds to its efficacy in a surprising way. Sulphate of potassa is the best cholagogue in the saline shape, and invariably enters largely into all the natural waters of use in hepatic congestion. But all the natural waters contain more or less sulphate of lime (in common *parlance*, plaster of Paris), which adds nothing to its efficacy, and is objectionable.

Again: in gouty and rheumatic diatheses, where an iodized alkaline aperient is indicated, the following may be prescribed, and will be found far more efficacious than any of the natural waters:

Dry sulphate of soda	3 ounces.
" " " potassa	6 drachms.
Bicarbonate of potassa	2½ drachms.
Carbonate of lithia	½ drachm.
Iodide of potassium	½ drachm.

Mix. Dose, a teaspoonful the first thing in the morning in half a pint of tepid water.

If the patient prefer cold to tepid water, plain cold, or aerated may be used.

In renal affections, where a course of the warm alkaline waters of Vichy or Carlsbad, or the cold ones of Val, Jachingen, and Marienbad are desired, we may use (as Dr. Wade suggests) dilute solutions of potassa and soda bicarbonate with citrate of lithia. Sir H. Page has found soft or distilled water of great service in the palliative treatment of renal affections, and either the one or the other should

always be used in the preparation of the solutions. They may be taken warm, or charged with carbonic acid.

By adopting such measures as these, we can confer, in some measure, the boon of mineral waters on the poor patients, which is now only enjoyed by the wealthy.—*Druggists' Circular.*

VICHY WATER, ARTIFICIAL.—Dorvault gives the following formula:

Sodium carbonate	1364 grains.
Sodium chloride	31 "
Calcium chloride, cryst	77 "
Sodium sulphate	77 "
Magnesium sulphate	21 "
Ferrous sulphate, cryst	1 "
Water	210 fl. oz.

Impregnate with 4 volumes of carbonic acid gas, at 5 atmospheres.

CONGRESS WATER, ARTIFICIAL.—The following formula represents the natural water, according to the best published analyses:

Sodium chloride	1966 grains.
Potassium chloride	163 "
Calcium carbonate, freshly prec	585 "
Magnesium carbonate, freshly prec	411 "
Sodium carbonate	83 "
Sodium bromide	16 "
Strontium carbonate, freshly prec	7 "
Ammonium chloride	3 "
Manganese carbonate	2 "
Sodium iodide	½ "
Iron, sulphate (ferrous)	2 "
Water, charged with carbonic acid gas	8¾ galls.

—*New Remedies.*

RUSSIAN REMEDY FOR HYDROPHOBIA.—A correspondent of *Land and Water* (London) describes the following Russian treatment of Hydrophobia: In Saraton the inhabitants collect the larva of the rose beetle (*Cetonia aurata*), which are chiefly found in the wood-ants' nest. The grubs are gathered in the spring, placed in earth, and their change of metamorphosis watched for. When this takes place they kill the beetles and dry them. The powdered insect must be kept in hermetrically sealed bottles, or the dried beetles may be kept in sealed pots and reduced to powder when wanted. Three beetles powdered are considered a dose for an adult, given immediately after the bite. One for a child and five for an adult in which the disease has declared itself. The effect is to produce a long sleep, which must not be interrupted. The bite is also treated surgically. The beetles caught on flowers are not so beneficial; they must be secured in the larva stage, and killed directly after they attain the imago. Some of the Russians give their dogs occasionally half a beetle as a preventive.

BOOK REVIEWS.

TERTIARY FLORA OF THE WEST, by Prof. L. Lesquereux; Hayden's U. S. Geological Survey, Volume VII, Government Printing Office, Washington. 1877.

We have received from Professor F. V. Hayden, the distinguished scientist, who for years has been in charge of the Geological Survey of the Western Territories, Volume 7, Tertiary Flora of the West, by Professor L. Lesquereux, of Columbus, Ohio, the venerable and eminent palæophytologist, whose specialty in Fossil Palæontology places him first in that department in the New World, and whose labors in the Carboniferous Flora of Pennsylvania, Ohio and Kentucky, and in the Tertiary of Alabama are so well known, and lastly, whose elaboration of the Lignitic Flora, now so splendidly completed, makes a most-fitting sequel to his unique Flora of the Dakota group.

This volume, of rare importance to Geology, is evidence of the sagacity and the true disinterestedness in the cause of science, shown by the selection of such a fellow-laborer by Prof. Hayden, whose staff of assistants combine together the very best intellect of the nation, whose zeal for science has a noble monument in the successive volumes of Hayden, Cope, Lesquereux, Meek, Holmes, Gardner, Maviue, Sullivan, Peale and other valuable assistants.

We will not here attempt to give more than an outline of the history of the Tertiary Flora of the West; which, since 1860, has occupied so much argument and study from its intimate connection with the age of the vast Lignitic Coal formation of the Rocky Mountains; extending from the estuary of the McKenzie river to Southern New Mexico, presenting an area of coal formations exceeding in amount all the coal fields of the so-called true carboniferous formation known in Europe, Asia and America.

To Lewis and Clark we are indebted for the first knowledge of the Lignite Coal, noticed by them in their exploration of the head of the Missouri river.

Later explorations revealed their presence in the Raton Mountains of New Mexico, while Milton and Cheadle and Dr. Hector have shown their large extent in British America, especially on the River Saskatchawan, where in latitude 51° 52′ north, the river banks show large deposits of excellent Lignite Coal; while the McKenzie lignites show in their fragmentary Flora a close alliance to the tertiary types of plants of the Lignite beds.

Even in Alaska Prof. Heer shows a small development of Lignite, probably miocene, and among whose plants we find some even identical to the Lignite Flora of Golden.

Prof. Lesquereux gives us, in the Tertiary Flora, his views of the value of the testimony of the few isolated cretaceous fossils, both vertebrate and invertebrate, that have been so much insisted upon as proving the cretaceous horizon of the Lignitic beds of the Rocky Mountains.

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Prof. Lesquereux carefully and patiently, and with rigorous justice, analyzes the comparative values of the evidence of the different species, genera and natural families, bearing upon the stratigraphical evidence of geological succession.

We may even say the geological habitat of each genera, and even of species, is rigorously compared with European authorities and European localities. His table of groups is also well imagined, showing clearly for every species their locality, and their appearance in well authenticated localities abroad, as well as in the West.

As might be expected, Prof. Lesquereux, after this final and more mature effort in elucidation of the problem of the age of the Lignitic formation, maintains his original ground of its tertiary origin, and as to the value of the testimony of a few vertebrate and invertebrate fossils, cited in evidence, against the clearly proven and well substantiated evidence of an overwhelming Tertiary Flora; whose types, genera and even species are identified in Alaska, Greenland, Switzerland, Bohemia, Italy, France, etc., all prove well established, undisputed Tertiary formation.

The theory of the learned Professor that inasmuch as "no remains of deep marine cretaceous types have been discovered in the whole Lignitic measures above Point of Rocks" locality, he is willing to admit, however, that as the Tertiary age in "principio" was necessarily a land formation, a cretaceous marine fauna may have still persisted in deep seas; that the presence of the Saurian Agathaumas at Black Buttes is the wandering of an animal out of its domain; the land surface at the Lignitic period was like the gulf shore at present time—a belt of sand downs served as a barrier to the sea; back of it there were marshy swamps, peat bogs, impenetrable by reason of luxuriant vegetation, whose animal life is limited to saurians. "A formation of the same kind is remarked all along the western coast of Africa."

The writer of this summary of the Tertiary Flora has seen very much the same on the coast of South America. A ridge of sand and comminuted corals and shells, forming a low breakwater, occasionally cut through at spring tides, the ridges covered with a dense growth of palms, brambles, manchineel and hibiscus, behind the ridge brackish water lagoons, into which, in the rainy season, emptied countless rivulets of fresh water, the drainage of vast and almost impenetrable swamps, the abode of a great variety of saurians, chelonians, and ophidians, with an occasional mammal, such as a manatee, or tapir, all other mammals, even monkeys, shunning their miasmatic solitudes. Here in the lagoons, whose underlying rock was Post Pliocene or Pliocene, could be found an extraordinary assemblage—fossil shells of the fresh water swamps mingled with the aviculas, solens, donax, arcas, pectens, turbas, ostreas, pholadas, cypreas, volutas and chambered spirulas of the adjoining sea. Hurled in among them or swept down by floods were green turtle and alligator bones, fresh water turtles, large boas, with an occasional tapir carcass, all mingled together in the deep black mud formed by the decay of an exuberant plant and tree growth, gathered in fathomless

swamps. Such, we may well conceive, were the conditions attending the slowly upheaved wastes of the Tertiary age.

Touching the question of superposition of formation, and the principles of the classification adopted in the case of the Tertiary formations, Messrs. Geikie and Jukes thus announce in their Manual of Geology, pages 670 to 672, Edinburgh edition 1872—*loc. cit.* Speaking of the Primary and Secondary epochs: "We can, therefore often determine their order of superposition by their geognostic relations only. * * * When, however, we come to examine the Tertiary rocks of the same area, we find that, either from having been deposited in separate seas, or from subsequent denudation, or from both causes combined, they now form detached patches, so their order of superposition can rarely be determined by simple inspection." Again, page 672: "*The Eocene beds of England* rest upon the upper surface of the *chalk* in *apparent* conformability; that is, there is no apparent *difference* in *the dip* or *strike* of the two groups. That there is, however, an unconformability between them, seems probable." An unconformability which can be seen at Golden and other points at the east base of the Rocky Mountains.

E. W. B.

Golden City, Colorado, March 20, 1878.

METHOD OF ARITHMETICAL INSTRUCTION, by F. W. Bardwell, Professor of Astronomy in the University of Kansas. G. P. Putnam's Sons, New York, 1878. pp. 36, 12mo. For sale by Matt. Foster & Co. 15c.

This is an essay by a skilled mathematician and experienced teacher, written in the interest of accuracy and perspicuity in text books of arithmetic, and introductory or rather preliminary to a work on Arithmetic now in preparation by the same author. Despite a somewhat hypercritical manner, it is full of ideas and points worthy of consideration by teachers who either follow the old time, rigid, non suggestive rules and methods, or who have attempted to keep abreast the somewhat effusive modern styles of teaching; and, judging from the clear and logical tone of the writer in this little monogram, the comprehensive treatise which is announced will be a valuable work for both students and professors.

THE SILVER COUNTRY, OR THE GREAT SOUTHWEST, by Alex. D. Anderson. G. P. Putnam's Sons, New York, 1877. pp. 221, 12mo. For sale by H. T. Wright & Co. $2.00.

Anything on the subject of silver is read with avidity at the present time, and this contribution to the literature of the much discussed metal, being replete with authentic statistics and written in an attractive style, will doubtless meet with a large demand. It is a review of the mineral and other wealth of the former kingdom of New Spain, comprising Mexico and the Mexican cessions to the United States, now subdivided into Texas, California, New Mexico, Nevada, Arizona and Utah, and aggregating 1,729,091 square miles.

After a general description of this immense territory, the author devotes nearly fifty pages to tabular statements of the silver and gold production of the

different sections, with comparative statistics instituted with reference to those of other auriferous and argentiferous regions of the world as well as to those of the world itself, making a most satisfactory case on all points.

Then follow two most fascinating chapters on "Other wealth than silver and gold," and "Luxuries and attractions," which portray in brilliant colors the remarkable products of the soil, the scenery and climate, fruits and wines, antiquities, &c. To those of our readers who have visited Nevada, Old and New Mexico, and many other portions of New Spain, this vivid description of its luxurious and spontaneous vegetation will seem largely overdrawn and may have the effect to cause them to discredit other statements in the work, but since full references to standard authorities are given in all instances where statistics of mineral wealth are furnished, these apparent exaggerations must be attributed to an enthusiastic partiality on the part of the author for the region he describes.

His comparisons show that this region from 1521 to 1804 yielded forty-three per cent. of the silver product of the whole world; from 1804 to 1848 fifty-six per cent.; from 1848 to 1868 fifty per cent.; from 1868 to 1875 sixty-five per cent.; and during 1875 seventy-five per cent. of the silver product of the world.

The conclusion is that if such has been the history of the Great Southwest in its comparatively undeveloped condition, the advance of railways into Arizona, New Mexico and the northern States of Old Mexico will give rise to a silver production still more wonderful.

The object of the book possibly reveals itself in the author's remarks upon the importance of railways and telegraphs in opening and settling up this region, by the aid of which "this rich land is destined to show a record of material development and wealth unparalleled by any history yet written."

Whether this is the real object of the book or not, its publication will have a tendency to give new zeal to the originators and managers of the Southern railway route to the Pacific and to enlist in the project many persons who have hitherto known very little about the country through which it passes.

The book is illustrated with a hypsometric map of the region under discussion, and is handsomely printed and bound.

THE BOY ENGINEERS: WHAT THEY DID, AND HOW THEY DID IT. A book for boys. By the Rev. J. Lukin. 334 pp. oct. 30 plates. G. P. Putnam's Sons, New York, 1878. For sale by Matt. Foster & Co. $1.75.

This is the third or fourth work of the same character by the same author, and being written in like fascinating style, it will doubtless meet with the same success as its predecessors.

It purports to be a record of the experiences of a couple of boy brothers, who, having a mechanical turn of mind, devoted themselves to the use of various tools in the construction of articles for use and amusement. These experiences, while related by the boys themselves in a clear and attractive manner, contain practical information upon numerous subjects of interest connected with the work in hand, and form a valuable guide for other boys who are similarly inclined.

Such books as these cannot fail to be of the greatest benefit to the boys of the present generation, and they should be found in every school library, as well as in the homes of all parents who wish to keep their boys out of the streets by the easy and practical method of entertaining them more agreeably at home.

Putnam's Sons have spared no pains to bring the book out in suitable and elegant style.

MEMOIR OF THE CENTENNIAL CELEBRATION OF BURGOYNE'S SURRENDER. Schuylerville, N Y., October 17, 1877. pp. 190, octavo. Joel Munsell, Albany, N. Y., 1878.

On the 19th of April, 1860, the Saratoga Monument Association was incorporated, its object being the collection of memorial data concerning the surrender of Burgoyne, and the erection of a monument to perpetuate the history of the occasion.

Seventeen years afterwards and just one hundred years from the day of the surrender, which was without doubt the turning point of the Revolution, the people of the vicinity and many from different portions of New York and the country at large, met at Schuylerville and laid with imposing forms and ceremonies the corner stone of a magnificent granite monument, almost upon the exact spot where on the 17th of October, 1777, General Burgoyne delivered up his sword and army to General Gates, commanding the American forces.

The occasion was befittingly celebrated and addresses were made by some of the most eminent orators in the country, among them Ex-Gov. Horatio Seymour, George William Curtis, Hon. L. S. Foster, Alfred B. Street, W. L. Stone, and others, all of which, together with many most interesting items of history, have been carefully brought together by William L. Stone, Secretary of the Monument Association, and handsomely preserved in the volume whose title is given above, by the publisher, Joel Munsell, who is also a well known antiquarian and writer of Albany, New York.

BETWEEN THE GATES, by Benj. F. Taylor. With illustrations. Chicago, S. C. Griggs & Co., 1878. 12mo. pp. 292.

The fascinating, though rather "red hot" style of Mr. Taylor, so well known to the many readers of his "World on Wheels," "Camp and Field," &c., is well kept up in this his latest work, and the many objects of interest seen between Chicago and San Francisco and upon the coast of California, during a summer's pleasuring, are described in an off-hand and at the same time a picturesque manner. Despite a proneness to the somewhat wearisome use of over familiar quotations and a weakness for rather feeble puns, Mr. Taylor's style is exceedingly attractive, and nothing worth seeing escapes his eyes. His descriptions of "the Californian twenty-two carats fine," and "the genuine old forty-niner, covered with Spanish moss and mistletoe," scorning the greenbacks, the nickels and the copper goddesses of Liberty of the "States" are in his finest vein, while that of "going to China," as he felicitously calls a visit to the Chinese quarter, is more

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strikingly, alarmingly suggestive of the Asiatic barbarism existing and tenaciously thriving in our land than all the comprehensive and long-winded reports which have yet been made to or by Congressional committees.

Every chapter teems with facts expressed in the most glowing language and and presented in a form which gives them the freshness of recent discoveries, from the visit to the Geysers to that to Los Angelos and the Mission of San Gabriel, and the book will be read with pleasure and profit by all. Like all of S. C. Griggs & Co.'s publications, this book is a model of good work in printing, paper and binding.

CHRONOLOGY OF THE ORIGIN AND PROGRESS OF PAPER AND PAPER MAKING, by Joel Munsell. Albany, N. Y. pp. 264. 12mo. $1.50.

This interesting work has passed through five editions and probably presents the most perfect history of the subject so far as chronology is concerned, that has been published.

Pliny states that Numa, who lived three hundred years before Alexander, (670 B. C.) left several works written upon papyrus, which is the earliest mention of its use among the Romans, though it is more than likely that the Egyptians used it centuries earlier.

In A. D., 95, Du Holde says that a mandarin of the palace manufactured paper of bark of trees and old silken and hempen rags. Casiri, a Spanish author, attributes the invention of cotton paper to Amru in A. D. 706 at Mecca, but it is attempted to be shown by Montfaucon that it was discovered in the empire of the East about the beginning of the 10th century, while other authorities equally good claim that the Chinese and Persians were acquainted with its manufacture much earlier than either of these dates.

The oldest manuscript in England written on cotton paper is in the Bodleian Collection of the British Museum, having the date A. D., 1049, while the oldest in France is to be found in the Royal Library at Paris dated A. D. 1050.

The first paper mill in America was established in 1690 near Philadelphia, by William Rittinghausen, now spelled Rittenhouse.

No end of substitutes for cotton rags have been proposed and tried, and in 1772 a book was printed in Germany containing upwards of sixty specimens of paper made of different materials—the result of one man's experiments.

A reading of this book reveals the fact that almost numberless patents have been issued to inventors for articles made of paper during the past century, from petticoats to car wheels.

The work is the result of diligent research, and is equally interesting to the general reader and valuable to the paper maker and stationer.

LENA, THE SILENT WOMAN, by the author of "King's Cope." Loring, Publisher, Boston, 1878. pp. 344. 12mo. 50c. Sold by H. H. Sheppard.

This is one of Loring's tales of the day, for town and country readers and is a very entertaining, readable tale of English life, though it would be difficult to explain why the author should have made Lena, who is his most attractive and

best character, both in person and in mind, the "silent woman" and should have finally closed the story leaving her an old maid, or at least unmarried. "Strange are the uses, &c."

THE UNIVERSE OF LANGUAGE: Uniform notation and classification of Vowels adapted to all Languages, by the late Geo. Watson, Esq., of Boston. Edited by his daughter. 12mo. pp. 344. New York: The Author's Publishing Co., 1878. Price $1.50.

While in part a labor of love on the part of a dutiful daughter in perpetuating the literary efforts of a revered father, this work is likewise a monument to the learning, industry and discriminative ability of both. Mr. Watson was a writer whose ideas were regarded as broad and comprehensive and at the same time expressed in scholarly language and attractive style. In this, his posthumous volume, none of these characteristics are wanting, while in respect of deep, careful, and impartial consideration of the subject, it is the best of all.

Miss Watson has evidently devoted much time and research to the same subject, and her contributions to the work are characterized by a skillful handling worthy of better known philologists.

The first part, upon the Nature of Language is by the daughter; the second, upon the Structure of Language, and the third, upon the Reading and Spelling Reform, are by the father.

The design of the author is to classify the natural sounds of the human voice as contained the various spoken languages, and to apply through this classification, a simple uniform system of pronunciation for all languages—Oriental as well as European; pointing out the elements in which all of them agree and thus approaching a Universal language. In attempting this the author has searched through those tongues descended from the Aryan, the Semitic and the Turanian for words, syllables and vocal sounds which are similar, and has arranged them in tables for comparison. Upon this basis he builds a plausible structure most interesting to the general reader and instructive and suggestive to the student of ancient and modern literature.

The work is published in good style and is offered at a lower price than usual for books of its size and class.

SMITHSONIAN REPORT, 1876. With appendix. Octavo, pp. 488. Washington: Government Printing Office, 1877.

This is the thirtieth report of the Regents of the Smithsonian institution, and comprises the report of the Secretary, the report of the Executive Committee, the proceedings of the Board of Regents for the annual session of 1877, and a general appendix consisting of valuable contributions to science from various sources, domestic and foreign.

The work done by this institution is probably less appreciated by the general mass of the people than that of any other association of distinguished scientists in the world. Aside from building up an immense and most interesting museum,

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art gallery and library, which are necessarily local in their benefits and influence, the Regents, under the management of Professors Henry and Baird, have persistently adhered to their original conception of the wishes and design of Smithson and devoted themselves to increasing and diffusing knowledge by means of researches, publications and exchanges, While a library of over 70,000 volumes has been gathered together, a museum probably unsurpassed in the world accumulated, and an art gallery, unusually attractive in many respects, founded, the main object, as they understand it, has not been overlooked. Many valuable works have been published, all branches of science have been advanced, and the Institution is most highly regarded by Scientists all over the world.

A HAND BOOK OF VOLUMETRIC ANALYSIS, by Edward Hart, S. B, Fellow of Chemistry in the John Hopkins University. New York: John Wiley & Sons, 1878. 12mo. pp. 326. Price $2.50.

Though designed by the author for use by college classes and in technical schools, this work will be found of extreme convenience to professors and practical chemists in their daily laboratory work and experiments.

Volumetric analysis, invented by Descroizilles and improved by Gay-Lussac, is principally adopted by those chemists who are engaged in technical work where frequently it is only necessary to ascertain the quantity of some one substance present in a known weight of a given specimen and where a speedy result is of importance.

Professor Hart has condensed the whole subject into a small compass but has apparently omitted no process which has stood the test of experience. His explanations are clear and simple and at the same time precise and exact.

Part I contains directions for the selection of apparatus, correction of errors, preparation of solutions, &c. Part II is devoted to the methods of estimating the elements and their more important compounds. Part III contains a few cases of the application of methods described in Part II.

Some of the more interesting chapters to the amateur chemist are those upon "Analysis of Silver Alloys, Coin, &c.," and upon "Water Analysis."

The index is very full and the whole work is arranged conveniently and logically for a hand-book or ready reference book. The mechanical work of the publishers is tasteful and substantial in all respects.

EDITORIAL NOTES.

In commencing the second volume of the REVIEW, we take occasion to thank the citizens of Kansas City, especially, for the support given it during the past year. They have, as in all matters of public enterprise, (for we presume no one has any idea that the REVIEW is expected or intended to be a profitable individual undertaking), come to its assistance as a matter of course, knowing that such publications, in their peculiar way, reflect credit upon the intelligence of the people among whom they are published, and add to the attractions of the place itself to intellectual and refined persons who are looking for homes in the West.

Aside from this consideration many have subscribed for it as the organ of the Kansas City Academy of Science, hoping to be of service to the cause of science by aiding in the publication of its proceedings and the papers read by its members.

Numbers doubtless have subscribed for it out of personal friendship for the editor. To all of these classes we are exceedingly grateful; at the same time we are not too modest to say that we think we are giving them their money's worth in full. Nor are we too proud to say that we need at least one hundred more subscribers in this city in order to make the REVIEW pay expenses, and we ought to have them. The subscription price is lower than that of any scientific periodical of the same size in the country, and every number contains something interesting and valuable to every person or family of intelligence in the city. Our list of contributors and exchanges is unsurpassed in the West, and both are increasing with each number, thus making it an easier task for the editor to furnish the variety necessary to suit and gratify readers of such diverse tastes and occupations. Take the present number as an example. In it we present our readers original articles by able writers from Missouri, Kansas and Colorado, and selections from some of the very best and most valuable periodicals in this country and Great Britain.

Without egotism we may point to the numerous complimentary comments by the scientific press of the country in corroboration of what we have said above, and close these remarks by urging our fellow citizens who have not already subscribed, to do so at once and thus enable us to carry forward this enterprise unhampered by the knowledge that we shall have to make up at the end of the year a pecuniary loss.

NUMBERS of our subscribers have availed themselves of the low price fixed in our last number for binding the REVIEW ($1.00 per volume), and express themselves well pleased with the work done. The offer is still open —or we can furnish a few volumes handsomely bound in half-morocco at $3.00 each.

The Kansas City Academy of Science has held two monthly meetings since our last issue, both of which were well attended, and proved very interesting to those present.

At the first, held on the evening of February 26, Judge E. P. West presided, and Professor Crosby read an article upon "Vesuvius," illustrated by plaster models, specimens from the volcano and photographs of various scenes in the buried cities. This interesting paper will be published in full in a subsequent number of the REVIEW.

Before the close of the meeting Professor Phillips, of the Benton School, was elected Recording Secretary.

The March meeting was held on the evening of March 26, 1878, and was also fully attended. Pres't R. T. Van Horn occupied the chair.

The first paper read was by Miss Mary E. Murdfeldt, of Kirkwood, Mo., upon the subject of "Forest Tree Borers." Miss Murdfeldt is a confirmed invalid, and devotes much of her time to Entomology. The paper attracted much attention, and was listened to with decided interest.

The second paper was by Capt. Trowbridge, upon "National Defense and Military

Education." This was so highly regarded that it was voted that a copy should be sent to the chairman of the House committee on Military Affairs, at Washington.

It must not be forgotten by our citizens that the next semi-annual meeting of the Kansas State Academy of Sciences will be held in this city in the month of June, and that the necessary steps for properly caring for the distinguished gentlemen who will be present at that time, must soon be taken by those interested.

DO NOT FORGET that we can club the REVIEW with any one of the scientific and literary magazines of the country, so as to save to subscribers one dollar or more on the two.

Mr. Guffin permits us to publish the following extract from a private letter of Rev. Henry W. Bellows, commendatory of Col. Van Horn's recent address before the Kansas City Academy of Science:

NEW YORK, April 1, 1878.

DEAR SIR: I have read with great interest the article of Hon. R. T. Van Horn on the Atmosphere, etc. If he is not a professional scientist it is all the more remarkable, and if he is, it is worthy of any one of them! It is so rare for scientists to put their knowledge into pleasant, readable English! If you meet him, give him my thanks and best respects.

I read a good deal of modern science, but rarely anything as fresh and satisfactory as this. I shall advise Prof. Youmans to copy it into the *Popular Monthly*, if he has not already cribbed it. * * *

Yours cordially,
H. W. BELLOWS.

When it is remembered that Dr. Bellows is a man who weighs his words, is one of the ripest scholars in the country, and if not reckoned among, is intimately associated with the eminent scientists both of this country and Europe, the compliment which he pays Col. Van Horn will be fully appreciated by his fellow citizens.

Besides this the following highly appreciative notice of Col. Van Horn's paper, appears in a communication to the Kansas City *Times* of March 29:

"The late paper of Col. R. T. Van Horn on the philosophy and phenomena of winds, read before the Academy of Sciences, and published in the *Western Review of Science and Industry*, makes a complete and most noticeable innovation upon the doctrines long since thought to be established. The author, though confronted by the dogmas of scientific men of all other times, goes right on, with a singular boldness of thought, in the very face of authority, and by a liberal and logical induction of facts does actually account for the phenomena of winds, storms, etc., upon a principle altogether new, while at the same time he most clearly demonstrates that atmospheric currents are not and cannot be referable to the heat of the solar rays, a doctrine held by meteorologists for more than two hundred years. I sincerely hope that the attention of thoughtful men throughout the country may be called to the consideration of the aforesaid paper, and it is to this end that this little note here appears."

We have also received very complimentary comments upon the same paper from Prof. Kedzie, of Manhattan, Kansas, Capt. Henry King, of Topeka, and many of the most intelligent of our own citizens. The paper has also elicited favorable notices from several more of our exchanges.

TO any new subscriber to the REVIEW for this year, who desires it, we will furnish a bound copy of the first volume for $3.00.

REV. HENRY WARD BEECHER, in his lecture here last month, while insisting upon the importance and necessity of absolute truth-telling at all times, declared that there were "more lies told in New York City in one day than the number of mosquitos bred in the Dismal Swamp in a year." To reduce this to actual figures: Every female mosquito lays from 250 to 350 eggs, (say 300), six times during an ordinary season. Of these probably three-fourths are destroyed either in

the egg or the larval state. Now, it is fair to suppose that in so large a body of land and water as the Dismal Swamp there are at least 10,000,000 of mosquitos to start with, one-half of which are females. On this basis we have 2,250,000,000 mosquitos produced in a single season, and, accordingly, 2,500 lies per day for every inhabitant of New York City! Sad if true!

THE meteorological records published on pages 25 and 27 of this number, show March, 1878, to have been of remarkably moderate temperature, but the following items from our own private record for the years 1867 to 1878 inclusive, (except 1874), will probably give to the ordinary reader a more appreciable idea of the *contrast between its temperature than that of any of them.* The same peach trees, for instance, bloomed in each of the above named years respectively, as follows: April 24th, 3d, 19th, 12th, 3d, 25th; May 3d; April 29th, 10th, 20th; *March 21st.* We cut asparagus from the same bed, as follows: 1869, April 18th; 1870, April 24th; 1871, April 9th; 1872, April 25th; 1875, April 29th; 1876, April 16th; 1877, April 21st; 1878, April 4th.

The latest snow or ice in each of the same years, was as follows: 1867, May 2d, snowed one inch; 1868, April 5th, ice half inch thick; 1869, April 12th, snowed at noon; 1870, April 16th, snowed several times, ice three-fourths inch thick; 1871, April 20th, snowed several times; 1872, May 1st, raw and cold with a little snow; 1873, April 15th, snowed all day; 1875, April 11th, snowed several times, April 17th, ice half inch thick; 1876, March 27th, 6 inches snow, disappearing April 4th; 1877, April 3d, snowed a little; 1878, *February* 24th, snowed nearly all day.

PUBLICATIONS RECEIVED.

With the beginning of the new volume we add to our exchange list the following well-known English periodicals, from which we shall, in the future, as in this number, make copious selections:

The Chemical News and Journal of Physical Science, Vol. xxxvii, London, England, weekly, edited by Wm. Crookes, F. R. S. Price 4d. This journal has been established twenty-six years, and is regarded by all chemists as one of the standard chroniclers of current discovery in Chemistry and Physical Science. Nor the least of its attractions consists of a weekly list of chemical periodicals published with abstracts of all their valuable articles susceptible of abridgment.

The Scientific and Literary Review, Vol. xiii, monthly, 16 pp. quarto. Price 6d., published by the Inventors' Association, 21 Cockspur St., London, England. This is a Record of Progress in Arts, Industry and Manufactures, and is carefully and ably edited. One of its most interesting features is its full and complete reports of the proceedings of the numerous learned societies in London and vicinity, which are extremely interesting.

IRON.—*The Journal of Science Metals and Manufactures*, established 1823, Vol. xi, new series, 20 pages folio, weekly. Price 6d. This is a newspaper somewhat similar in appearance and purpose to the *Scientific American*, and is copiously illustrated. Particular attention is paid, as its title indicates, to iron and steel productions, but its general scope takes in all matters connected with manufactures in all lines and materials.

The Qaarterly Journal of Science, No. LVII, January, 1878, Ludgate Hill, London, England, edited by Wm. Crookes, F. R. S., etc., pp. 144, octavo. Price 5 shillings. It is altogether unnecessary to say anything concerning the character and objects of this well-known periodical, as its reputation is world-wide. The contents of the present number, besides its copious notices of Scientific Works, are as follows: 1. Continuous Railway Brakes, by Fred. Chas. Danvers. 2. On Residual Phenomena. 3. The Action of Light upon the Colouration of the Organic World. 4. On the Discovery of Stone Implements in Glacial Drift in North America. 5. New Theory of Trance.

We have also received as exchanges, *The American Manufacturer and Builder*, Vol. x, published by H. N. Black, and edited by P.

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H. Vander Weyde, M. D., New York. The *Manufacturer and Builder* is a large monthly folio of 24 pages, ably edited, handsomely printed, and profusely illustrated. It is devoted, as its title indicates, to the interests of Architects, Artisans, Manufacturers and Builders, and should have as large circulation among such classes in the West as it has in the East.

Potter's American Monthly Magazine, published by J. E. Potter & Co., Philadelphia. Price $3. This is one of the handsomest, cheapest and most popular literary monthlies in the country. It is in its tenth volume, and its reputation is becoming better with each year. The April number has articles by popular and accomplished writers on Ceramic Art, Archæology, The Thousand Islands of the St. Lawrence, etc., all graphically and fully illustrated.

T. B. PETERSON & Brothers, Philadelphia, Pa., are now publishing a new edition of Charles Dickens' novels, which for beauty and cheapness far surpasses any ever before issued. It is called "Peterson's American Edition," printed on fine white paper, from large clear type, leaded, with some of the original illustrations as selected by Mr. Dickens and designed by Phiz, Cruikshank, Browne, Maclise and other artists, and bound very gorgeously in red vellum, gold and black, with the cover filled with the author's principal characters, which he has made so world-famous. There in one corner is the immortal Pickwick, in another the well known Micawber, the learned Capt. Cuttle, poor little Oliver Twist, the misguided Grandfather, the mean, hypocritical Pecksniff, the mercenary Squeers, Boots, The Beadle, etc., and all of this for the small sum of $1.25. This edition will be found for sale at all Book Stores, News Stands, and on all Rail Road Trains, or any person sending the Publishers $12.00 will receive the first twelve volumes as fast as published by mail, postage paid, and at this low price every one that is fond of a handsome book ought to subscribe. Address all orders to T. B. Peterson & Brothers, No. 306 Chestnut Street, Philadelphia, Pa.

The current numbers of Popular Science Monthly and Supplement, Van Nostrand's Engineering Magazine, Scientific American, Boston Journal of Chemistry, Silliman's Journal, Journal of the Franklin Institute, London Journal of the Telegraph, London Journal of Applied Science, Monthly Weather Review, American Naturalist, The Sanitarian, and Phrenologist are at hand, and contain articles of the highest value in their respective departments of science.

Also, North American Review, The Atlantic Monthly, The International, Harper's Monthly, and Appleton's Journal, five of the very best literary journals in the United States, to which we have frequently referred in these columns and shall frequently do so hereafter. Also the Library Table, The Literary World, The Bookseller, &c.

Also, the Gardener's Monthly, Kansas Farmer, Western Agriculturist, all first-class agricultural papers.

We have also been favored with the Leavenworth Daily Times, Brookfield Gazette, Ouray Times, Miami Republican, Industrialist, Kansas Collegiate, Dade County Advocate, Utica Herald, all of which have kindly noticed the REVIEW from time to time, and are justly entitled to our thanks.

Our own Kansas City papers, The Journal of Commerce, Times, Evening Mail, Price Current, and Post and Tribune have at all times encouraged the REVIEW, and have generously aided it with good words, for which we are under continual obligations.

All subscribers who have not paid their subscriptions for last year will oblige us by doing so as soon as possible.